Allen-Bradley

1336 IMPACT™ Adjustable Frequency AC Drive

519 - 597 kW (700 - 800 HP)

Troubleshooting Manual

Rockwell Automation

Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. "*Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls*" (Publication SGI-1.1 available from your local Allen-Bradley Sales Office or online at **http://www.ab.com/manuals/gi**) describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will the Allen-Bradley Company be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, the Allen-Bradley Company cannot assume responsibility or liability for actual use based on the examples and diagrams.

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Throughout this manual we use notes to make you aware of safety considerations.

ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss.

Attentions help you:

- identify a hazard
- avoid the hazard
- recognize the consequences

Important: Identifies information that is especially important for successful application and understanding of the product.

Shock Hazard labels may be located on or inside the drive to alert people that dangerous voltage may be present.

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Preface

Manual Objective

The information in this manual is designed to help troubleshoot or repair an Allen-Bradley 1336 IMPACT Adjustable Frequency AC Drive with ratings B700C – B800C and C700C – C800C.

Who Should Use This Manual

This manual is intended for qualified service personnel responsible for troubleshooting and repairing the 1336 IMPACT Adjustable Frequency AC Drive. You should:

- Read this entire manual before performing maintenance or repairs to drives.
- Have previous experience with, and basic understanding of, electrical terminology, procedures, required equipment, equipment protection procedures and methods, and safety precautions.

This manual describes equipment, troubleshooting and disassembly procedures. You begin with general illustrations and end with greater detail concerning replacement parts and part locations on the drives. Later chapters may refer you back to earlier chapters for information on basic equipment and steps necessary to perform detailed diagnostics and part replacement.

Safety Precautions

ATTENTION: Some printed circuit boards and drive components may contain hazardous voltage levels. Remove and lock out power before you disconnect or reconnect wires, and before you remove or replace fuses and circuit boards. Verify bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three bus fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Potentially fatal voltages may result from improper usage of oscilloscope and other test equipment. The oscilloscope chassis may be at a potentially fatal voltage if not properly grounded. If an oscilloscope is used to measure high voltage waveforms, use only a dual channel oscilloscope in the differential mode with X 100 probes. It is recommended that the oscilloscope be used in the A minus B Quasi-differential mode with the oscilloscope chassis correctly grounded to an earth ground.

ATTENTION: Only personnel familiar with the 1336 IMPACT Adjustable Frequency AC Drive and associated machinery should plan or implement the installation, start-up and subsequent maintenance of the system. Failure to comply may result in personal injury and/or equipment damage.

Electrostatic Discharge Precautions

ATTENTION: This assembly contains parts and sub-assemblies that are sensitive to electrostatic discharge. Static control precautions are required when servicing this assembly. Component damage may result if you ignore electrostatic discharge control procedures. If you are not familiar with static control procedures, reference Rockwell Automation Publication 8000-4.5.2, *Guarding Against Electrostatic Damage*, or any other applicable ESD protection handbook.

Electrostatic discharge generated by static electricity can damage the complementary metallic oxide semiconductor devices on various drive boards. It is recommended that you perform these procedures to guard against this type of damage when circuit boards are removed or installed:

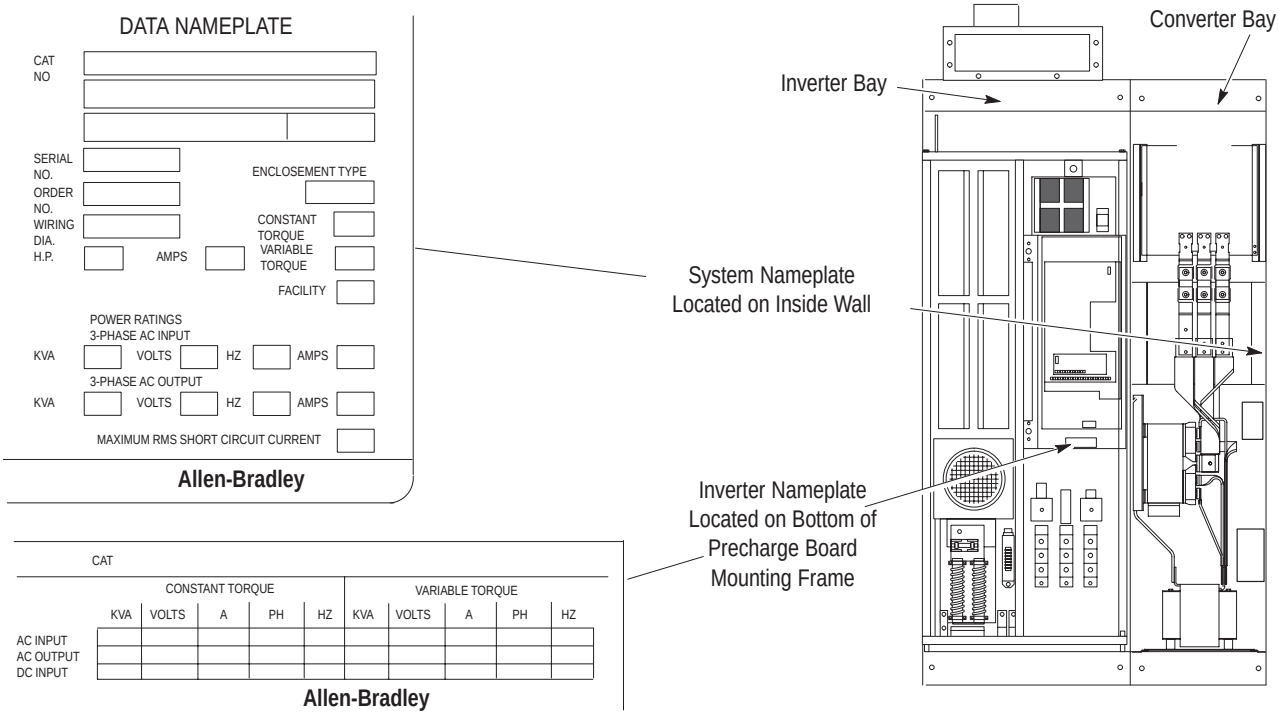
- Wear a wrist-type grounding strap that is grounded to the drive chassis.
- Attach the wrist strap before removing the new circuit board from the conductive packet.
- Remove boards from the drive and immediately insert them into their conductive packets.

1336 IMPACT Product Identification

Drive Nameplate Location

The system nameplate is located on the right side of the Converter Bay. The system nameplate contains the drive's catalog number and other important drive information. Reference the catalog number when ordering replacement parts. Another nameplate, for the Inverter, is located on the face of the Precharge Board Mounting Frame.

Figure P.1
Drive Nameplate Locations



Drive and Option Identification

The following is an explanation of the catalog numbering system for 1336 IMPACT Adjustable Frequency AC Drives and options. The catalog number is coded to identify the drive power rating and can be found on the drive nameplate and on the shipping carton.

1336 IMPACT Drive Catalog Numbers

Table P.A
Catalog Numbers

1336E	– B700C	– AA	– HA1C	– GM1C	– CB	– BM
Bulletin No.	Drive Rating Code (Refer to Table P.B)- (Must Be Specified)	Enclosure Code (Refer to Table P.C) (Must Be Specified)	Human Interface Code (Refer to Table P.D)[1] (Optional)	Communication Options Code (Refer to Table P.E)[1] (Optional)	Configuring Options Code (Refer to Table P.F)[1] (as required)	Other Option Codes (Refer to Tables P.G and P.H)[1] (as/if required)

1 As many valid options as required may be strung together with a dash between each option code number.

Drive Rating Qualifications

Several factors can affect drive rating. If more than one factor exists, consult Rockwell Automation.

Table P.B
Drive Rating Code

Frame Designation	Rating Code[1]	AC Input V AC[2]	Nominal HP[2]	Output Amps (Derate Base)[2]	Derate Curve[3 4]	Heat Dissipation				
						Drive Watts[3 4]	Heat Sink Watts[3]	Converter Watts	Choke Watts	Total Watts[3]
H	C700C	380 – 480	700	770.0	5	1700	9700[4]	1750	875	14025
	C800C	380 – 480	800	800.0	5	1900	12000[4]	2000	1000	16900
	B700C	575 – 600	700	850.0	5	1800	9400[4]	1750	875	13825
	B800C	575 – 600	800	983.0	5	2000	11300[4]	2000	1000	16300

1 This manual does not apply to 12 pulse or 18 pulse drives – rating codes 12C700C, 18C700C etc.

2 Base derate amps are based on nominal input voltage (480 or 575V). If the input voltage exceeds the drive rating, the drive output must be derated. Refer to the 1336 IMPACT User Manual.

3 Drive ambient temperature rating is 40°C. If ambient exceeds 40°C, derate the drive. Refer to the 1336 IMPACT User Manual.

4 Drive rating is based on altitudes of 1000m (3000 ft) or less. If installed at a higher altitude, derate the drive. Refer to the 1336 IMPACT User Manual.

5 Refer to the 1336 IMPACT User Manual

Enclosure Type

The first character, *A*, indicates the Enclosure Code.

The second character indicates the type of enclosure shipped from the factory:

Table P.C
Enclosure Type Code

Enclosure Type Code	Description
AA	NEMA Type 1 (IP 20)

HIM and Communication Options

Table P.D
HIM Code

HIM Options Code	Description[1]	NEMA Type
HAB	Blank – No Functionality	Type 1 (IP 20)
HAP	Programmer Only	
HA1	Programmer, LCD/Analog Pot	
HA2	Programmer, LCD/Digital Pot	
HJP	Programmer Only	Type 12 (IP 54)[2]
HJ2	Programmer, LCD/Digital Pot	

1 For a more functionally complete description of each option, refer to Publication 1336 IMPACT-1.0.

2 Configured only.

Table P.E
Communication Code

Communication Options Code	Description[1]
GM1	Single Point Remote I/O
GM2	RS-232/422/485, DF1
GM3	RS-232/422/485, DH485

1 For a more functionally complete description of each option, refer to Publication 1336 IMPACT-1.0.

Configured Options

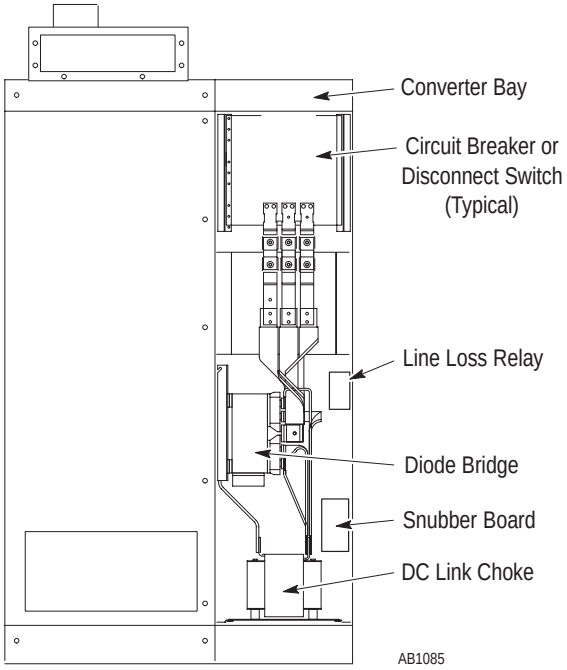
All H Frame systems are configured, which means that each system is built and tested to a specific order. Configuration also means that considerable variation between systems is possible. The variations are all in the Converter Bay (the cabinet to the right), where power is converted from an AC input to DC power.

A primary variation between systems is the incoming power connection. Table P.F lists typical code combinations used to specify input circuits. Figure P.2 shows a typical Converter Bay.

Table P.F
Configuration Code

Configuring Code Combinations	Description
CB	Circuit Breaker
LR or LT	Input Line Reactor
KM	Drive Output Contactor
MK or MT	Motor Thermal Overload Relay
CB	Circuit Breaker
KD	Drive Input Contactor
MK or MT	Motor Thermal Overload Relay
DS	Drive Input Fused Disconnect Switch
KM	Drive Output Contactor
MK or MT	Motor Thermal Overload Relay
DT	Non-Fused Drive Disconnect Switch
KD	Drive Input Contactor
KM	Drive Output Contactor
DS	Drive Input Fused Disconnect Switch
BA or BM	Bypass
FM	Bypass Mode Motor Fuse Block
CC	Bypass Circuit Breaker
KD	Drive Input Contactor
CB	Drive Circuit Breaker
BA or BM	Bypass
CC	Bypass Circuit Breaker
KD	Drive Input Contactor
CB	Drive Circuit Breaker
BS, BD, BP, or BC	SMC Bypass
DT	Non-Fused Drive Disconnect Switch
KD	Drive Input Contactor
DS	Drive Input Fused Disconnect Switch
BS, BD, BP, or BC	SMC Bypass

Figure P.2
Typical Converter Bay



Other Options

Table P.G
L Option Board Codes

L Option Board Options Code	Description[1]
L4	Contact Closure
L7E	Contact Closure & Encoder Feedback
L5	+24V AC/DC
L8E	+24V AC/DC & Encoder Feedback
L6	115V AC
L9E	115V AC & Encoder Feedback

1 For a more functionally complete description of each option, refer to Publication 1336 *IMPACT-1.0*.

Table P.H
Language Module Codes

Language Modules Option Code	Description
EN	English/English
FR	English/French
DE	English/German
IT	English/Italian
JP	English/Japanese
ES	English/Spanish

Conventions

To help differentiate parameter names and display text from other text in this manual, the following conventions will be used:

- Parameter Names will appear *italicized*.
- Display Text will appear in “quotes”.

The following is a list of conventions used throughout this manual, and definitions of the conventions.

Auxiliary Input

The Auxiliary Input is a terminal connection on the L Option Board. This connection provides an external input for use as an Auxiliary Interlock. Unless this interlock is closed, the drive will be faulted with an Auxiliary Fault.

Auxiliary Interlock

The Auxiliary Interlock is a user supplied circuit consisting of reset, overload, or other interlocking circuitry. The Interlock is wired to the drive Auxiliary input.

Bit

A bit is a single character or status point used in programmable logic. Eight bits form a BYTE, 16 bits form a word. Drive parameters are actually eight bits or 16 bit words.

Check

To check means to examine either the physical condition of something or the setting of some control, such as a Parameter. Checking a drive board or component may also require measurements and tests.

Connector

A connector connects one drive board to another. Connectors come in two designs, male and female. Male connectors are stationary and contain pins, which are sometimes joined by jumpers. Female connectors are at the ends of wires or ribbon cables and plug into male connectors.

Default

When a drive function defaults, it automatically changes to a pre-programmed setting.

Enable Input

The Enable Input is a terminal connection on the L Option Board. This connection provides an external input to enable or disable the Drive Output section. It must be true to permit the drive to operate.

False

False refers to a logical false state. For instance, an L Option signal on TB3 is false when the input contact is open or the appropriate voltage is not applied to the L Option Board.

Jumper

A jumper completes a circuit between two pins within a male connector on a drive board. In the absence of certain optional equipment using female connectors, jumpers are applied to certain pins within a male connector to complete specific and necessary circuits.

L Option Board

An L Option Board plugs into connectors J7 and J9, located on the lower portion of the Control Board. This board is identified as L4, L5, L6, L7E, L8E, or L9E and provides optional control wiring configurations for a drive.

Parameter

Parameters are programmable drive functions that define various operating functions or status displays of a drive. Refer to 1336 IMPACT Adjustable Frequency AC Drive User Manual for parameter details.

Press

Press a button on the Human Interface Module to change parameter settings and drive functions.

True

True refers to a logical true state. For instance, an L Option signal on TB3 is true when: L4/L7E contact input is closed, L5/L8E input terminal registers 24V, or L6/L9E input terminal registers 115V AC.

Related Publications

The following lists other Allen-Bradley publications that apply to the 1336 IMPACT Adjustable Frequency AC Drives:

- Product Pricing Bulletin (1336 IMPACT-3.0)
- 1336 IMPACT User Manual (1336 IMPACT-5.0)
- Renewal Parts List[1]
- Options Manuals/Instructions
- Product Data DriveTools Software (9303-2.0)
- Bulletin 1201 Graphic Programming Terminal User Manual (1201-5.0)
- 1336–5.91, Multipulse Bridge Assembly Parts Kit

[1] Current 1336 IMPACT spare parts information, including recommended parts, catalog numbers, and pricing, can be obtained from the following sources.
- Allen-Bradley home page on the World Wide Web at:
  http://www.ab.com
  Select **Drives**, and the select **Information for Drives, Including Part Lists . . .** Select document **1070.pdf** (460 & 575V drives).
- Standard Drives "AutoFax" service — an automated system that you can call to request a "faxed" copy of the spare parts information (or other technical documentation).
  Simply call **444-646-6701** and follow the phone prompts to request document **1070** (460 & 575V drives).

Control Logic Wiring and Adapters

Chapter Objectives

This chapter introduces you to components used for local programming of the drive.

Chapter Overview

This chapter illustrates and describes:

- L Option boards L4, L5, L6, L7E, L8E, and L9E, including terminal block TB3
- TB3 L Option mode selections and functions
- TB3 terminal designations
- The Human Interface Module (HIM)

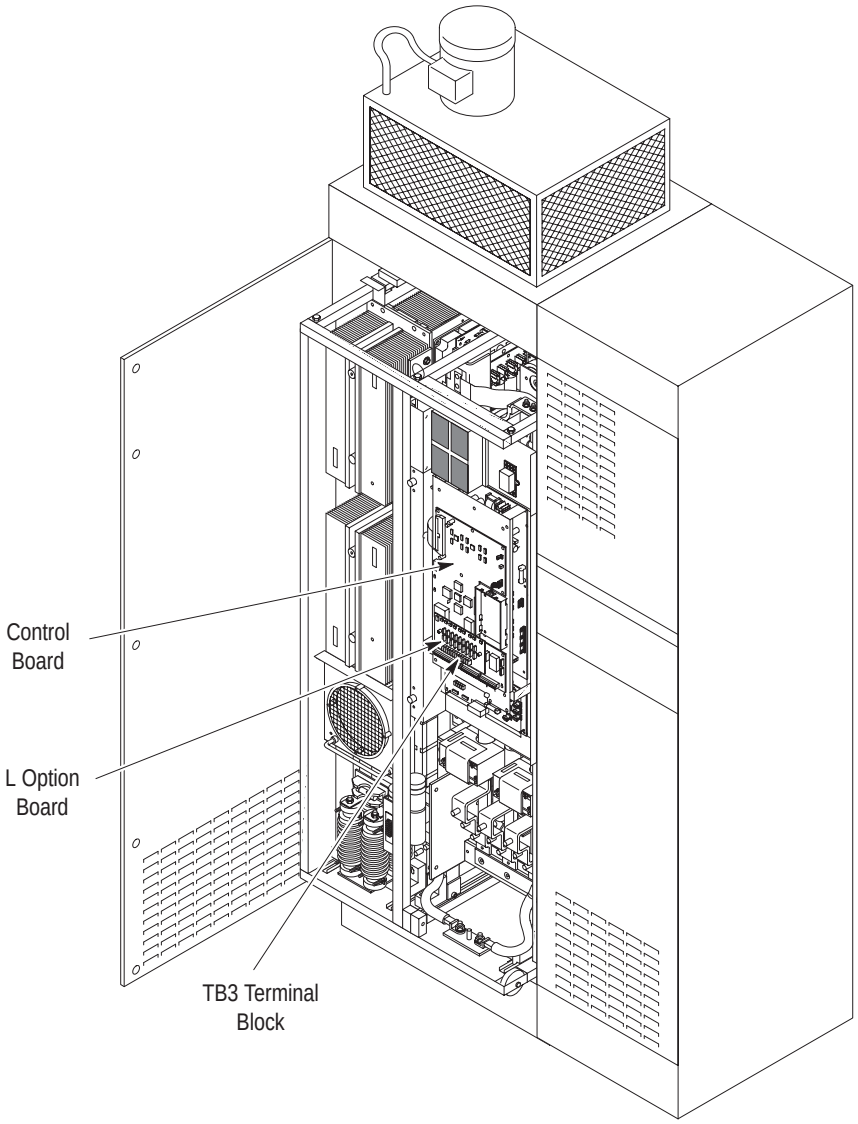
To access these components, refer to *Opening the Drive Enclosure* in Chapter 3, *Access Procedure*s.

ATTENTION: Some printed circuit boards and drive components may contain hazardous voltage levels. Remove power before you disconnect or reconnect wires and before you remove or replace fuses and circuit boards. Verify bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three bus fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

Important: All printed circuit boards, except the Control Board assembly, are referenced to the negative (–bus).

ATTENTION: This assembly contains parts and sub-assemblies that are sensitive to electrostatic discharge. Static control precautions are required when servicing this assembly. Component damage may result if you ignore electrostatic discharge control procedures. If you are not familiar with static control procedures, reference Rockwell Automation Publication 8000-4.5.2, *Guarding Against Electrostatic Discharge*, or any other applicable ESD protection handbook.

Figure 1.1
TB3 Terminal Block Location



ATTENTION: The National Electric Code (NEC) and local codes outline provisions for safely installing electrical equipment. Installation must comply with specifications regarding wire types, conductor sizes, branch circuit protection and disconnect devices. Failure to do so may result in personal injury and/or equipment damage.

L Option Board

The L Option Board provides a means of interfacing various signals and commands to the 1336 IMPACT drive by using contact closures.

Six different versions of the L Option are available:

L4	Contact Closure Interface[1]
L7E	Contact Closure Interface with Encoder Feedback[1]
L5	+24V AC/DC Interface
L8E	+24V AC/DC Interface with Encoder Feedback
L6	115V AC Interface
L9E	115V AC Interface Interface with Encoder Feedback

[1] Uses internal +5V DC supply.

The user inputs are connected to the L Option Board through TB3. The L4, L5, and L6 options each have nine inputs: seven user-configurable inputs and two factory-defined control inputs. The function of each L Option must be selected through programming as explained later in this section. The L7E, L8E, and L9E options are similar to L4, L5, and L6 with the addition of encoder feedback inputs.

Control Board Jumpers for L Option

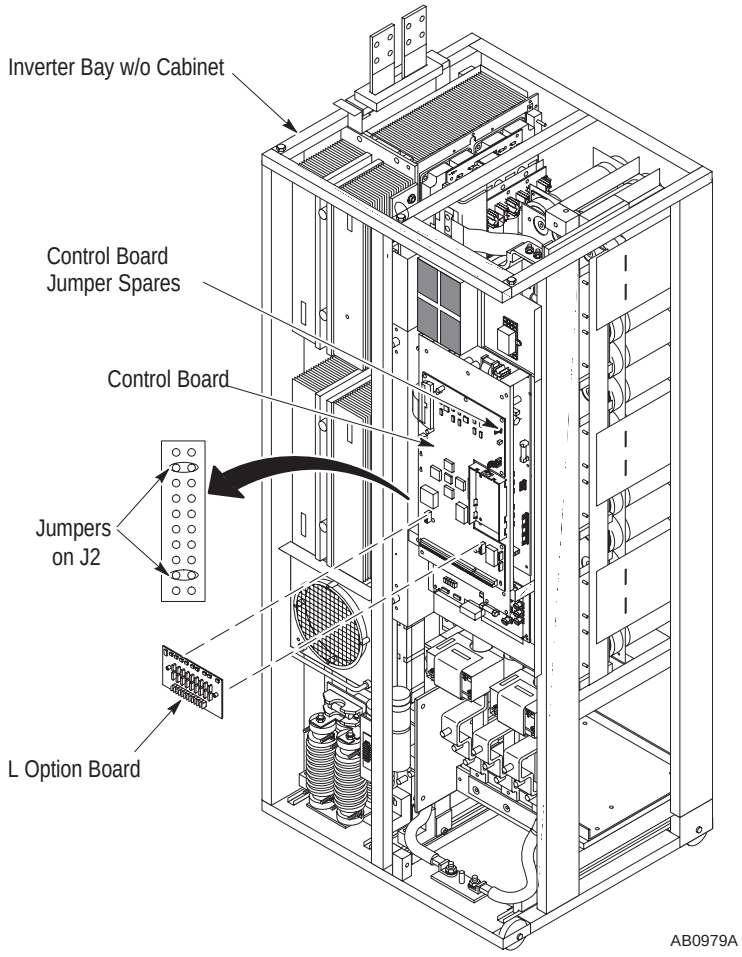
Important: If the L Option Board is being installed, Control Board jumpers at pins 3 & 4 and 17 & 18 of J2 must be removed. If these jumpers are removed, they can be stored on the "spares" location on the Control Board. Refer to Figure 1.2. If the L Option board is removed, these jumpers must be reinstalled, the *L Option Mode* parameter must be programmed to "1" and the drive power must be cycled.

Available Inputs

The L Option allows the combination of the following functions:

Accel/Decel Rates	Process Trim
Digital Potentiometer (MOP)	Ramp
Enable	Reset
Flux Enable	Run Forward
Forward/Reverse	Run Reverse
Jog	Speed Selects
Local Control	Speed Torque Selections
Not Ext Flt	Start
Not Stop, Clear Fault	Stop Mode Selects

Figure 1.2
Jumper Locations



The available combinations are shown in Figure 1.3. Programming the *L Option Mode* parameter to one of the L Option Mode numbers listed selects that combination of input functions.

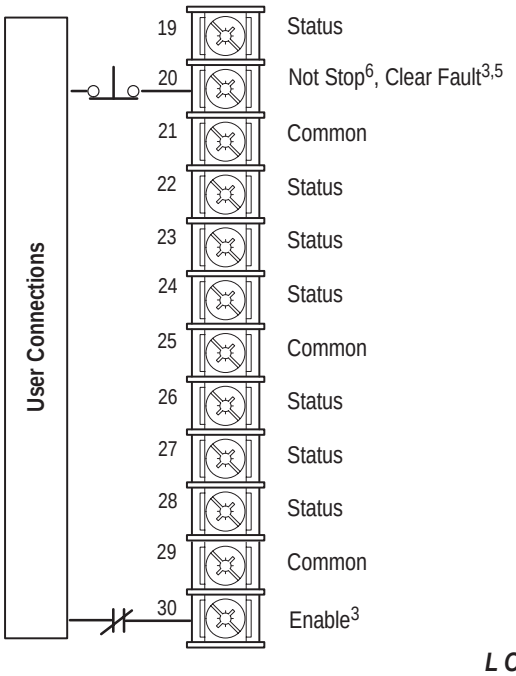
Important: The *L Option Mode* parameter can be changed at any time; however, programming changes will not take effect until power has been cycled to the drive. When changing an input mode, it is important to note that the corresponding inputs to TB3 may also change.

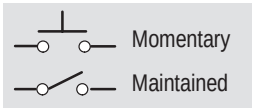
The programming options of the L Option Board allow you to select an input combination to meet the needs of a specific installation. Appropriate selection of a combination may be done by using Table 1.A. First determine the type of start/stop/direction control desired. Then select the remaining control functions available. After selecting a group of L Option Modes, use Table 1.A for specific mode selection. Record the selected mode number below.

Selected Mode Number:_____

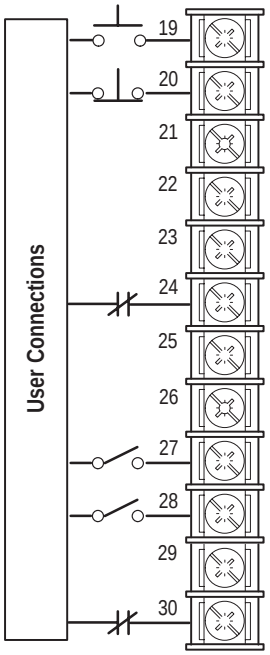
Figure 1.3
L Option Mode Selection and Typical TB3 Connections

L Option Mode **(parameter 116) = 1**
Factory Default





L Option Mode **(parameter 116) = 2 – 6, 17, 18, and 27**
Single-Source, Three-Wire Control



	Mode							
	2	3	4	5 [8]	6	17	18	27 [8,9]
	Jog	Stop Type [6]	2nd/1st Accel	Digital Pot Up	Jog	Proc Trim	Flux En	Digital Pot Up
	Speed Select 3[1]	Speed Select 3[1]	2nd/1st Decel	Digital Pot Dn	Local Control[2]	Ramp	Reset	Digital Pot Dn

1 Refer to Table 1.B.

2 Drive must be stopped to take Local Control. Control by all other adapters is disabled (except Stop).

3 These inputs must be present before drive will start.

4 Bit 11 of *Logic Options* (parameter 17) must be 0 for reverse direction control.

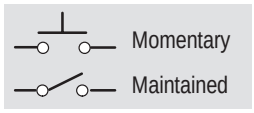
5 For soft faults only. You need to recycle power to the drive or reset to clear. For hard faults, refer to Chapter 2, *Troubleshooting and Error Codes*.

6 To configure the stop type, refer to *Logic Options* (parameter 17).

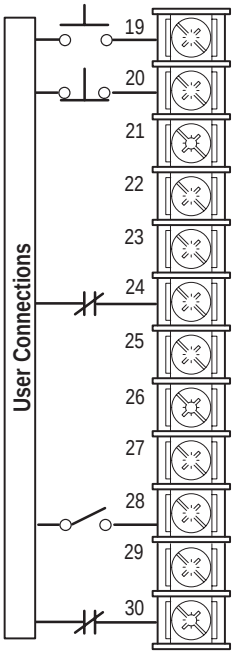
7 Latched starts require a stop to stop the drive.

8 In mode 5, the MOP value is not reset to 0 when you stop. In mode 27, the MOP value is reset when you stop.

9 Available in versions 2.02 and later.

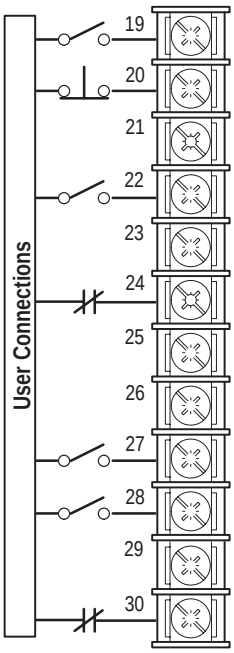


L Option Mode (parameter 116) = 7 – 11, 19 – 22, 28 and 29
Multi-Source, Three-Wire Control



	Mode										
	7	8	9 [4]	10 [4]	11	19	20	21	22	28 [4,8]	29 [4,8]
Start [9]	Reverse [5]	Reverse [5]	Digital Pot Up	Reverse [5]	1st Accel	Speed/ Torque 3 [10]	Speed/ Torque 3 [10]	Reverse [5]	Speed/ Torque 3 [10]	Digital Pot Up	Reverse [5]
Not Stop [7], Clear Fault [3,6]	Forward [5]	Forward [5]	Digital Pot Dn	Forward [5]	2nd Accel	Speed/ Torque 2 [10]	Speed/ Torque 2 [10]	Forward [5]	Speed/ Torque 2 [10]	Digital Pot Dn	Forward [5]
Common											
Precharge Enable	Jog	Speed Select 3 [1]	Speed Select 3 [1]	Digital Pot Up	1st Decel	Speed/ Torque 1 [10]	Speed/ Torque 1 [10]	Ramp	Speed/ Torque 1 [10]	Speed Select 3 [1]	Digital Pot Up
Common											
Speed Select 1 [1]	Speed Select 2 [1]	Speed Select 2 [1]	Speed Select 2 [1]	Digital Pot Dn	2nd Decel	Process Trim	Flux Enable	Reset	Speed Select 2 [1]	Speed Select 2 [1]	Digital Pot Dn
Common											
Enable [3]											

L Option Mode (parameter 116) = 12 – 16, 23 – 26, and 30
Single-Source, Two-Wire Control



	Mode									
	12	13	14	15 [4]	16	23	24	25	26	30 [4,8]
Run Forward [5,11]	Local Control [2]	Stop Type [7]	2nd/1st Accel	Digital Pot Up	Local Control [2]	Process Trim	Flux Enable	Process Trim	Jog	Digital Pot Up
Not Stop [7], Clear Fault [3,6]										
Common										
Run Reverse [5,11]										
Precharge Enable										
Common										
Speed Select 2 [1]	Speed Select 3 [1]	Speed Select 3 [1]	2nd/1st Decel	Digital Pot Dn	Stop Type	Reset	Reset	Ramp	Speed Select 3 [1]	Digital Pot Dn
Speed Select 1 [1]										
Common										
Enable [3]										

1 Refer to Table 1.B.

2 Drive must be stopped to take Local Control. Control by all other adapters is disabled (except Stop).

3 These inputs must be present before drive will start.

4 In modes 9, 10, and 15, the MOP value is not reset to 0 when you stop. On modes 28, 29, and 30, the MOP value is reset when you stop.

5 Bit 11 of *Logic Options* (parameter 17) must be 0 for reverse direction control.

6 For soft faults only. You need to recycle power to the drive to clear. For hard faults, refer to Chapter 2, *Troubleshooting and Error Codes*.

7 To configure the stop type, refer to *Logic Options* (parameter 17).

8 Available in versions 2.02 and later.

9 Latched starts require a stop to stop the drive.

10 Refer to Speed/Torque Select table 1.C.

11 Unlatched start.

Local Programming

For local programming and control information, refer to the 1336 IMPACT User Manual.

Table 1.A
L Option Mode Selection

Start/Stop Type	Direction Control	Communication Compatibility	Mode(s) to Use
Stop & Enable Only	None	Control must be provided by HIM or Communication Option.	1
Momentary Pushbutton (3 Wire)	Maintained Switch (Open-Forward, Closed-Reverse) Single-Source	Start/Stop – works like the HIM and Communication Options. Direction Control will not work with HIM or Communication Options. User must select direction control from either HIM and Communication Options or TB3 input.	2 – 6, 17, 18, and 27[2]
Momentary Pushbutton (3 Wire)	Momentary Pushbuttons (Forward and Reverse) Multi-Source	Start/Stop – works in parallel with HIM and Communication Options. Direction – works in parallel with HIM or Communication Options.	7 – 11, 19 – 22, and 28, 29[2]
Maintained switches for combined run and direction control (2 wire, Run Forward, Run Reverse)		Start – works differently than three-wire control.[1] Direction – works differently than three-wire control.[1] Stop – always works.	12 – 16, 23 – 25, and 30[2]

[1] Refer to two-, three-wire notes in the user manual.

[2] Diodes 27 – 30 are available with versions 2.02 and later.

Figure 1.3 provides the terminal designations for TB3. The maximum and minimum wire sizes accepted by TB3 are 2.1 and 0.30 mm^2 (14 and 22 AWG). Maximum torque for all terminals is 1.4 N-m (12 lb-in.). Use copper wire only.

Figure 1.4
TB3 Terminal Designations

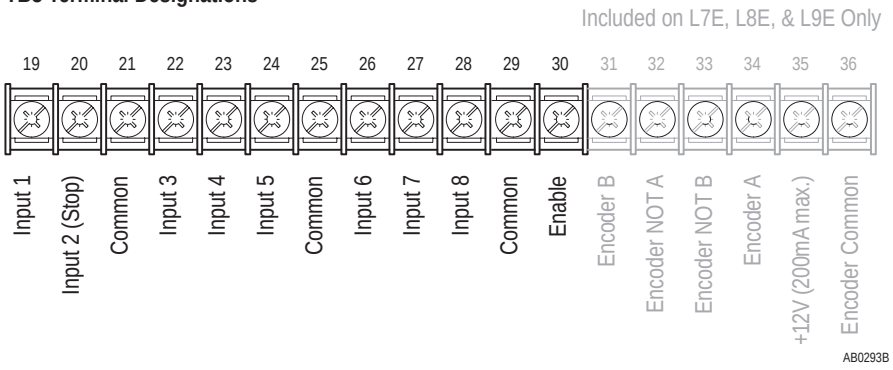


Table 1.B defines the input state of the Speed Select inputs for a desired speed reference source.

Table 1.B
Speed Select/Speed Reference

Speed Select 3	Speed Select 2	Speed Select 1	Frequency Source
O	O	O	Speed Ref 1
O	O	X	Speed Ref 2
O	X	O	Speed Ref 3
O	X	X	Speed Ref 4
X	O	O	Speed Ref 5
X	O	X	Speed Ref 6
X	X	O	Speed Ref 7
X	X	X	Last State

O=Open = Removed=0

X=Closed = Applied=1

Table 1.C defines the input state of the Speed/Torque Mode Select inputs for a desired speed/torque mode.

Table 1.C
Speed/Torque Select

Speed/Torque Mode Select 3	Speed/Torque Mode Select 2	Speed/Torque Mode Select 1	Speed/Torque Mode
O	O	O	Zero Torque
O	O	X	Speed Regulate
O	X	O	Torque Regulate
O	X	X	Minimum Torque/Speed
X	O	O	Maximum Torque/Speed
X	O	X	Sum of the Torque and Speed
X	X	O	Zero Torque
X	X	X	Zero Torque

O=Open = Removed=0

X=Closed = Applied=1

Human Interface Module (HIM)

Description

When the drive-mounted HIM is supplied, it will be connected as SCANport 1 (refer to Figure 1.5). The HIM can be divided into two sections: Display Panel and Control Panel. The Display Panel provides a means of programming the drive and viewing the various operating parameters. The Control Panel allows different drive functions to be controlled. For HIM operation, refer to the 1336 IMPACT User Manual.

Important: The operation of HIM functions depends upon drive parameter settings. Default parameter values allow full HIM functionality.

Figure 1.5
Human Interface Module – Inverter Mounted

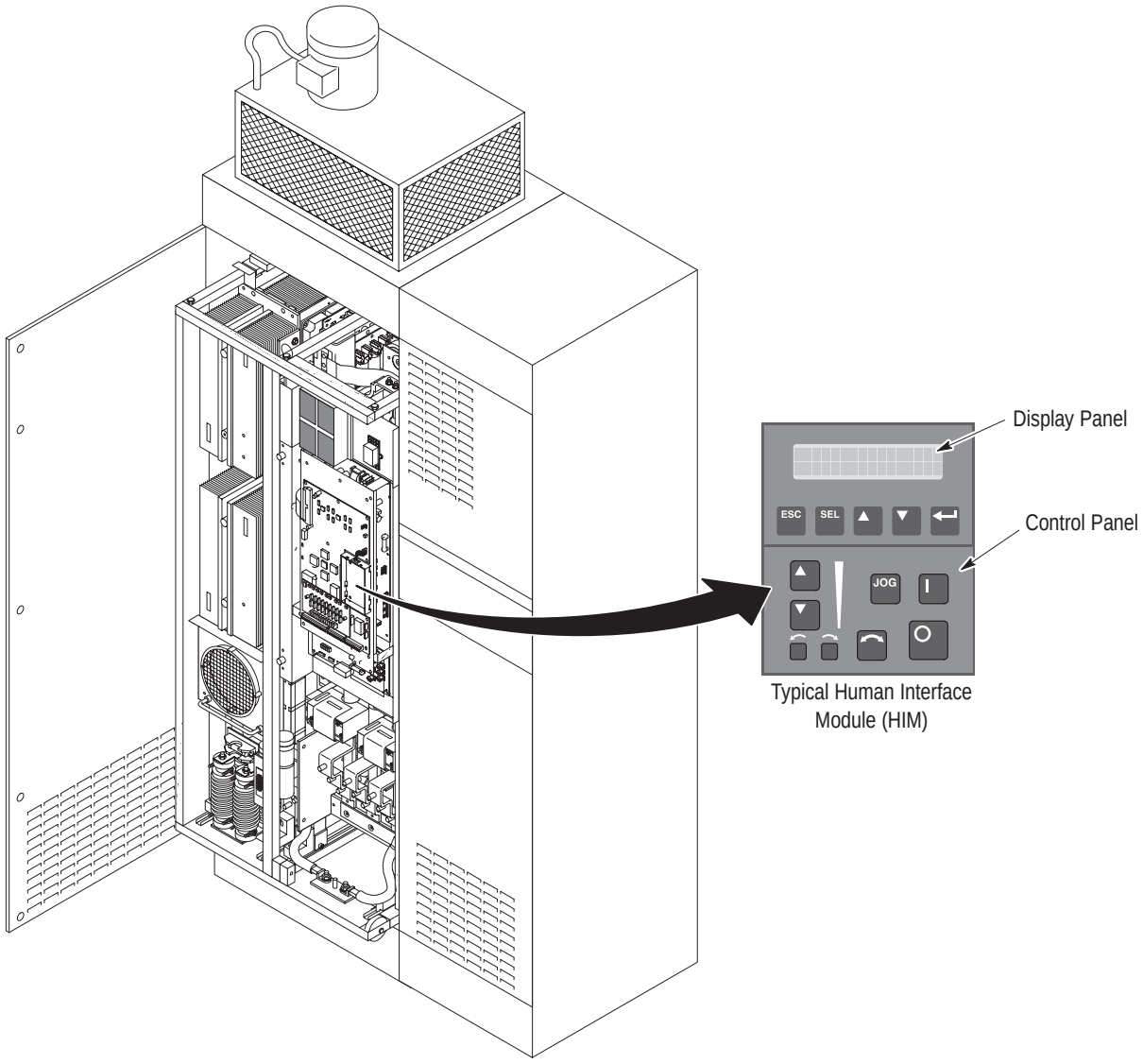
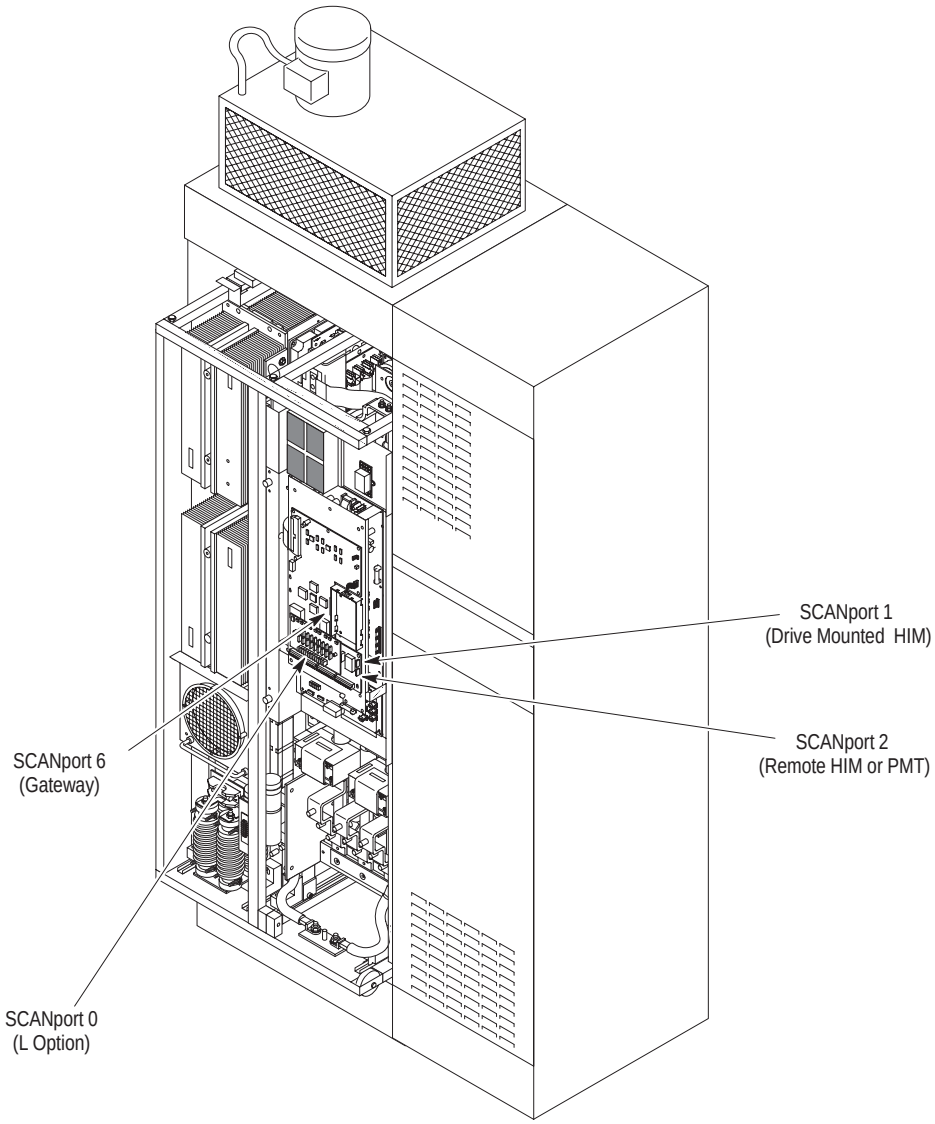


Figure 1.6
SCANport Locations



Removing the HIM

For handheld operation, you can remove the module and place it up to 10 meters (33 feet) from the 1336 IMPACT drive. (You do need a cable to do this.)

ATTENTION: Some voltages present behind the drive front cover are at incoming line potential. To avoid an electric shock hazard, use extreme caution when removing/replacing the HIM.

Important: Removing a HIM (or other SCANport device) from a drive while power is applied causes a Serial Fault, except as follows:
– Setting bit 1 of *SP Enable Mask* (parameter 124) to 0 disables the Serial Fault from a HIM on port 1. It also disables all HIM control functions except Stop.
– Setting bit 9 of *Fault Select 1* (parameter 20) to 0 disables the Serial Fault from the HIM on port 1, but still allows HIM control.
– Disabling *Control Logic* (from the *Control Status* menu) (only available on a Series A, version 3.0 or Series B HIM) disables the Serial Fault.

ATTENTION: Hazard of personal injury or equipment damage exist. If you initiate a command to start motor rotation (command a start or jog) and then disconnect the programming device, the drive will not fault if you have the SCANport communications fault set to be ignored for that port.

To remove the HIM, you need to:

1. Prevent the drive from faulting by either:
   – Removing the power or
   – Clearing the appropriate port bit. Depending on the port where the HIM is attached, either in *SP Enable Mask* clear parameter 124, or in *Fault Select 1* clear parameter 20.
2. Remove the front cover of the drive.
3. Push release at the bottom of the HIM cradle and slide the module down out of its cradle.

To use the module from anywhere up to 10 meters (33 feet) from your drive, you need to:

1. Connect the appropriate cable between the HIM and the communications port (adapter 2, 3, 4, or 5) or adapter 1 (the HIM cradle).
2. Set *SP Enable Mask* to enable the port that you plugged the HIM into and/or *Fault Select 1* (parameter 20).

To replace the module, follow these steps:

1. Slide the module up into its cradle.
2. Replace the front cover of the drive.
3. Apply power, set *SP Enable Mask* or set *Fault Select 1*.

HIM Operation

When power is first applied to the drive, the HIM will cycle through a series of displays. These displays will show drive ID and communication status. Upon completion, the Status Display (refer to Figure 1.7) will be shown. This display shows the current status of the drive (i.e. Stopped, Running, etc.) or any faults that may be present (Not Enabled, etc.).

Refer to the 1336 IMPACT User Manual for HIM operation.

Figure 1.7
Status Display

DriveTools

DriveTools software is a Windows 95, 98, or NT(4.0) compatible family of application programs allowing the user to perform programming, monitoring, and diagnostic operations on Allen-Bradley AC and DC digital drive products. The software consists of five Windows applications. For operation, refer to the Product Data DriveTools Software manual.

Control Firmware Function

All control functions in the 1336 IMPACT drive are performed through the use of parameters that can be changed with a programming terminal or DriveTools. Refer to the overview Block Diagram of the Control Firmware Function in the 1336 IMPACT User Manual.

Feedback information is derived from hardware devices as part of the process equipment used. Analog signals are converted to digital signals for use by the drive. Control signals may be provided to the drive by the Control Board.

All setup and operation information used by the drive is stored in a system parameter table. Every parameter, including Setup and Configuration parameters (Sources and Destinations), has an entry in the parameter table. For example, parameter 29 is named the *Speed Ref 1* parameter and contains a number value representing the speed reference. The speed reference can originate from an external control device such as a potentiometer connected to the analog input of the Control Board. Refer to the 1336 IMPACT User Manual.

Troubleshooting and Error Codes

Chapter Objectives

This chapter provides information to help troubleshoot your 1336 IMPACT drive.

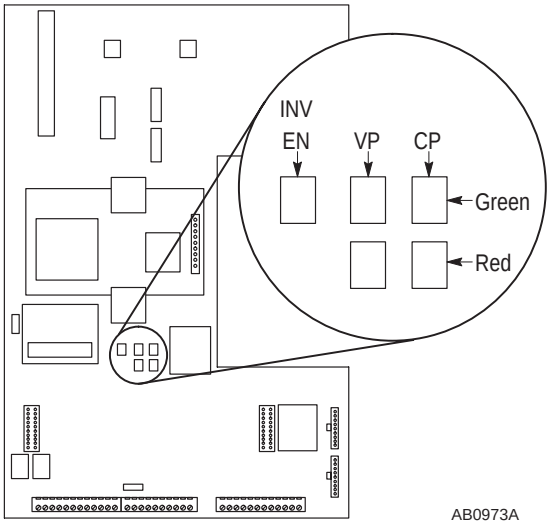
ATTENTION: Do not troubleshoot or maintain the 1336 IMPACT drive unless you are familiar with your drive system and the associated machinery. You may be injured and/or the equipment may be damaged if you do not comply.

During the start-up procedure, you should have recorded board jumper settings for each board, board software version numbers, and the drive and motor nameplate data in Table 6.A of the 1336 IMPACT User Manual. If this information was not recorded, record it before beginning any troubleshooting sequences.

Fault/Warning Handling

When a problem occurs with your drive, check the VP and CP LEDs on your drive on the Control Board. Figure 2.1 shows the location of the VP and CP LEDs.

Figure 2.1
VP and CP LED Locations



The LEDs on the Control Board indicate the status of the velocity processor (VP) and current processor (CP):

If the VP or CP LED is:	Then, for that processor:
Solid green	No fault occurred.
Flashing green	A drive warning occurred.
Flashing red	A drive soft fault occurred.
Solid red	A drive hard fault occurred.

Faults fall into three basic categories:

Category:	Has the following definition:	To remove this fault, you need to:
Hard Fault	Trips the drive causing it to stop. You cannot regain control until you reset the drive.	Perform a *Drive Reset* command or cycle drive power.
Soft Fault	Trips the drive causing it to stop.	1 Address the condition that caused the fault. 2 Perform a *Clear Faults* command.
Warning	Indicates an undesirable condition. The drive will not stop, but the condition may lead to a fault that will stop the drive.	Address the condition that caused the warning.

Faults are annunciated on the Human Interface Module (HIM) at the time they occur. Warnings are not annunciated on the HIM.

To help troubleshoot your 1336 IMPACT drive, the drive logs any faults or warnings in either the fault or warning queue. The faults and warnings that are contained in the queues are either configurable or non-configurable.

This fault type:	Refers to faults that you:
Configurable	Can set up to either trip the drive or provide only a visual warning while the drive continues to operate.
Non-configurable	Cannot disable. These faults are the result of a condition that could damage the drive if allowed to persist.

You can reset the soft faults by pressing the stop button on the HIM.

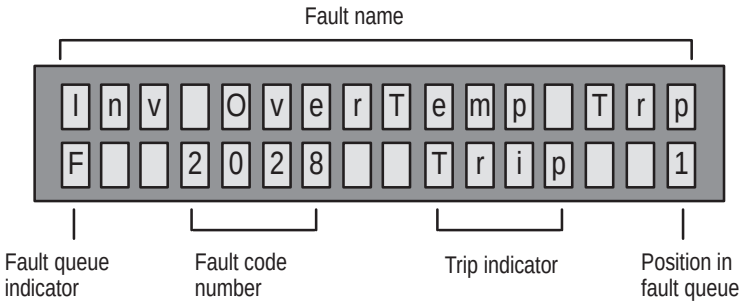
Viewing the Fault and Warning Queues on the HIM

You can use the HIM to view the fault and warning queues. To view the fault queue, you need to:

1. Press the *Escape* key until you reach the *Choose Mode* level.
2. Use the *Increment* or *Decrement* key to scroll through the *Choose Mode* options until *Control Status* is displayed.
3. Press the *Enter* key.

4. Use the *Increment* or *Decrement* key to scroll through the *Control Status* options until *Fault Queue* is displayed.
5. Press the *Enter* key.
6. Press the *Enter* key when *View Queue* is displayed.

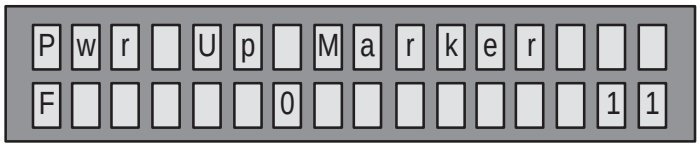
The fault queue can contain up to 32 faults. The 1336 IMPACT drive reports the faults using the following format:



The trip indicator is only present if this fault caused the drive to trip.

The last number (1) indicates the position of this fault within the fault queue.

A marker is placed in the queue when the first fault occurs after a power up sequence. This power up marker is as shown.



The 1336 IMPACT drive tracks the time that has elapsed since power up. The drive uses this information as a time stamp so that you can tell when a fault occurred in relation to when the drive was powered up.

To clear the fault queue, select *Clear Queue* from the *Fault Queue* options.

To view the warning queue, select *Warning Queue* from the *Control Status* options. The remaining steps are the same as for the fault queue.

Fault Descriptions

When a fault occurs, the fault is displayed until you initiate a *Drive Reset* or a *Clear Faults* command. A *Drive Reset* clears all faults, while a *Clear Faults* command only clears soft and warning faults. You can perform a *Drive Reset* and *Clear Faults* either through bits in *Logic Input Sts* (parameter 14) or with a terminal.

The fault codes are defined as shown in Table 2.A.

Table 2.A
Fault Descriptions

Fault Code and Text	LED Status	Fault Type	Description	Suggested Action
01027 *Autotune Diag*	VP, Flashing red	Soft	The drive encountered a problem while running the autotune tests. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Check *Autotune Errors* (parameter 176). For additional information about *Autotune Errors*, refer to Chapter 13, *Understanding the Autotuning Procedure*, in the user manual.
01051 *MtrOvrld Pnd*	VP, Flashing red	Soft	A motor overload is pending. The drive has reached 95% of the level required for a motor overload trip (see fault 01052).	Check for possible motor overheating. • If the motor temperature is excessive, reduce the accel/decel times (parameters 42–45) or reduce the load. • If the motor temperature is acceptable, increase the value of *Motor Overload %* (parameter 26). If you do not want this condition to be reported as a fault, change bit 3 in *Fault Select 2* (parameter 22) to 0.
01052 *MtrOvrld Trp*	VP, Flashing red	Soft	Motor overload tripped. The drive has reached the level of accumulated motor current over time as set by *Motor Overload %* (parameter 26).	Check for possible motor overheating. • If the motor temperature is excessive, reduce the accel/decel times (parameters 42–45) or reduce the load. • If the motor temperature is acceptable, increase the value of *Motor Overload %* (parameter 26). If you do not want this condition to be reported as a fault, change bit 4 in *Fault Select 2* (parameter 22) to 0.
01053 *Mtr Stall*	VP, Flashing red	Soft	The drive is in a limit condition for a period of time in excess of the value specified in *Motor Stall Time* (parameter 25) with the motor at zero speed.	Check *Torque Limit Sts* (parameter 87) to see which limit has occurred. Increase the appropriate limit parameter or reduce the load. If you do not want this condition to be reported as a fault, change bit 5 in *Fault Select 2* (parameter 22) to 0.
01083 *MtrOvrld Pend*	VP, Flashing green	Warning	Motor overload pending. The drive has reached 95% of the level required for a motor overload trip (see fault 01084).	Check for possible motor overheating. • If the motor temperature is excessive, reduce the accel/decel times (parameters 42–45) or reduce the load. • If the motor temperature is acceptable, increase the value of *Motor Overload %* (parameter 26). If you do not want this condition to be reported as a warning, change bit 3 in *Warning Select 2* (parameter 23) to 0.

Fault Code and Text	LED Status	Fault Type	Description	Suggested Action
01084 *MtrOvrld Trp*	VP, Flashing green	Warning	Motor overload tripped. The drive has reached the level of accumulated motor current over time as set by *Motor Overload %* (parameter 26).	Check for possible motor overheating. • If the motor temperature is excessive, reduce the accel/decel times (parameters 42–45) or reduce the load. • If the motor temperature is acceptable, increase the value of *Motor Overload %* (parameter 26). If you do not want this condition to be reported as a warning, change bit 4 in *Warning Select 2* (parameter 23) to 0.
01085 *Mtr Stall*	VP, Flashing green	Warning	The drive is in a limit condition for a period of time in excess of the value specified in *Motor Stall Time* (parameter 25) with the motor at zero speed.	Check *Torque Limit Sts* (parameter 87) to see which limit has occurred. Increase the appropriate limit parameter or reduce the load. If you do not want this condition to be reported as a warning, change bit 5 in *Warning Select 2* (parameter 23) to 0.
02028 *Inv Overtemp Trp*	VP, Flashing red	Soft	Inverter overtemperature trip. There is excessive temperature at the heatsink. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Check the cabinet filters, drive fans, and heatsinks. Check the thermal sensor and sensor wiring (connector). Reduce the load or duty cycle if possible. Lower the value of *PWM Frequency* (parameter 10).
02049 *Inv Overtemp Pnd*	VP, Flashing red	Soft	An inverter overtemperature is pending. The inverter heatsink temperature is approaching the trip level.	Check the cabinet filters, drive fans, and heatsinks. Check the thermal sensor and sensor wiring (connector). Reduce the load or duty cycle if possible. Lower the value of *PWM Frequency* (parameter 10). If you do not want this condition to be reported as a fault, change bit 1 in *Fault Select 2* (parameter 22) to 0.
02061 *InvOvld Pend*	VP, Flashing red	Soft	An inverter (IT) overload is pending. The inverter current has been in excess of 105% of *Inverter Amps* (parameter 11) too long. Continued operation at this load level will cause an overload.	Reduce the load or duty cycle if possible. If you do not want this condition to be reported as a fault, change bit 13 in *Fault Select 2* (parameter 22) to 0.
02063 *Inv Overload*	VP, Flashing red	Soft	Inverter (IT) overload. The inverter current has been in excess of 105% of *Inverter Amps* (parameter 11) too long.	Reduce the load or duty cycle if possible. If you do not want this condition to be reported as a fault, change bit 15 in *Fault Select 2* (parameter 22) to 0.

Fault Code and Text	LED Status	Fault Type	Description	Suggested Action
02081 *Inv Overtemp Pnd*	VP, Flashing green	Warning	An inverter overtemperature is pending. The inverter heatsink temperature is approaching the trip level.	Check the cabinet filters, drive fans, and heatsinks. Check the thermal sensor and sensor wiring (connector). Reduce the load or duty cycle if possible. Lower the value of *PWM Frequency* (parameter 10). If you do not want this condition to be reported as a warning, change bit 1 in *Warning Select 2* (parameter 23) to 0.
02093 *InvOvld Pend*	VP, Flashing green	Warning	An inverter (IT) overload is pending. The inverter current has been in excess of 105% of *Inverter Amps* (parameter 11) too long. Continued operation at this load level will cause an overload.	Reduce the load or duty cycle if possible. If you do not want this condition to be reported as a warning, change bit 13 in *Warning Select 2* (parameter 23) to 0.
02095 *Inv Overload*	VP, Flashing green	Warning	Inverter (IT) overload. The inverter current has been in excess of 105% of *Inverter Amps* (parameter 11) too long.	Reduce the load or duty cycle if possible. If you do not want this condition to be reported as a warning, change bit 15 in *Warning Select 2* (parameter 23) to 0.
03008 *HW Malfunction*	VP, Red 1 blink	Hard	A hardware malfunction was detected on power up or reset. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Recycle the power. If the fault does not clear, replace the Control Board.
03009 *HW Malfunction*	VP, Red 2 blink	Hard	A hardware malfunction was detected on power up or reset. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Recycle the power. If the fault does not clear, replace the Control Board.
03010 *HW Malfunction*	VP, Red 3 blink	Hard	A hardware malfunction was detected on power up or reset. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Recycle the power. If the fault does not clear, replace the Control Board.
03011 *HW Malfunction*	VP, Red 4 blink	Hard	A hardware malfunction was detected on power up or reset. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Recycle the power. If the fault does not clear, replace the Control Board.
03012 *HW Malfunction*	VP, Red 5 blink	Hard	A hardware malfunction was detected on power up or reset. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Recycle the power. If the fault does not clear, replace the Control Board.

Fault Code and Text	LED Status	Fault Type	Description	Suggested Action
03014 *EE Checksum*	VP, Flashing red	Soft	The parameter database is corrupt.	Initialize parameters or: •Perform a Recall Values operation. •Perform a Save Values operation. •Verify the parameters. •Reset the drive. If the fault still occurs, replace the Control Board.
03015 *HW Malfunction*	VP, Flashing red	Soft	A hardware malfunction has occurred.	Recycle the power. If the fault does not clear, replace the Control Board.
03022 *Diff Drv Type*	VP, Flashing red	Soft	The Control Board has been initialized on a different size drive.	Issue a *Reset Defaults* command to set the drive parameters back to the default values.
03023 *SW Malfunction*	VP, Solid red	Hard	A software malfunction has occurred.	Recycle the power. If the fault does not clear, replace the Control Board. If the fault still occurs, replace the Gate Driver Board.
03024 *SW Malfunction*	VP, Solid red	Hard	A software malfunction has occurred. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Recycle the power. If the fault does not clear, replace the Control Board.
03025 *Absolute Overspd*	VP, Flashing red	Soft	The motor speed has exceeded the speed limit plus *Absolute Overspd* (parameter 24) settings. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	If operating in torque mode, check if the load is allowing excessive motor speed. Check if the setting of *Absolute Overspd* (parameter 24) or the speed limits (parameters 40 and 41) are too low.
03026 *Analog Spply Tol*	VP, Flashing red	Soft	The analog supply tolerance voltage is outside of the 13V to 18V range. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Possible faulty analog 15V power supply. The gate driver board or the Control Board may require replacement.
03029 *SW Malfunction*	VP, Solid red	Hard	A software malfunction has occurred.	Recycle the power. If the fault does not clear, replace the Control Board.
03030 *SW Malfunction*	VP, Solid red	Hard	A software malfunction has occurred. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Recycle the power. If the fault does not clear, replace the Control Board.
03031 *SW Malfunction*	VP, Solid red	Hard	A software malfunction has occurred.	Recycle the power. If the fault does not clear, replace the Control Board.
03040 *mA Input*	VP, Flashing red	Soft	A loss of 4–20mA input has occurred.	Check your wiring and connections. If the fault does not clear, replace the Control Board. If you do not want this condition to be reported as a fault, change bit 8 in *Fault Select 1* (parameter 20) to 0.

Fault Code and Text	LED Status	Fault Type	Description	Suggested Action
03057 *Param Limit*	VP, Flashing red	Soft	A parameter limit has occurred.	Examine the parameter limit testpoints to determine the exact cause. Refer to the *Understanding Parameter Limit Faults* section in the troubleshooting chapter of the user manual. If you do not want this condition to be reported as a fault, change bit 9 in *Fault Select 2* (parameter 22) to 0.
03058 *Math Limit*	VP, Flashing red	Soft	A math limit has occurred.	Examine the math limit testpoints to determine the exact cause. Refer to the *Understanding Math Limit Faults* section in the troubleshooting chapter of the user manual. If you do not want this condition to be reported as a fault, change bit 10 in *Fault Select 2* (parameter 22) to 0.
03072 *mA Input*	VP, Flashing green	Warning	A loss of 4–20mA input has occurred.	Check your wiring and connections. If you do not want this condition to be reported as a warning, change bit 8 in *Warning Select 1* (parameter 21) to 0.
03089 *Param Limit*	VP, Flashing green	Warning	A parameter limit has occurred.	Examine the parameter limit testpoints to determine the exact cause. Refer to the *Understanding Parameter Limit Faults* section in the troubleshooting chapter of the user manual. If you do not want this condition to be reported as a warning, change bit 9 in *Warning Select 2* (parameter 23) to 0.
03090 *Math Limit*	VP, Flashing green	Warning	A math limit has occurred.	Examine the math limit testpoints to determine the exact cause. Refer to the *Understanding Math Limit Faults* section in the troubleshooting chapter of the user manual. If you do not want this condition to be reported as a warning, change bit 10 in *Warning Select 2* (parameter 23) to 0.
05048 *Spd Fdbk Loss*	VP, Flashing red	Soft	A loss of feedback occurred.	Check the encoder wiring. Verify that the encoder signals are free of noise. If you do not want this condition to be reported as a fault, change bit 0 in *Fault Select 2* (parameter 22) to 0.
05054 *External Flt In*	VP, Flashing red	Soft	The external fault input from the L Option board is open.	Check the external circuit for cause of an open input signal. If you do not want this condition to be reported as a fault, change bit 6 in *Fault Select 2* (parameter 22) to 0.

Fault Code and Text	LED Status	Fault Type	Description	Suggested Action
05080 *Spd Fdbk Loss*	VP, Flashing green	Warning	A loss of feedback occurred.	Check the encoder wiring. Verify that the encoder signals are free of noise. If you do not want this condition to be reported as a warning, change bit 0 in *Warning Select 2* (parameter 23) to 0.
05086 *External Flt In*	VP, Flashing green	Warning	The external fault input from the L Option board is open.	Check the external circuit for cause of an open input signal. If you do not want this condition to be reported as a warning, change bit 6 in *Warning Select 2* (parameter 23) to 0.
06041 *SP 1 Timeout*	VP, Flashing red	Soft	The SCANport adapter at port 1 has been disconnected and the logic mask bit for port 1 is set (1).	If the adapter was not intentionally disconnected: •Check the wiring to the SCANport adapters. •Replace wiring, SCANport expander, SCANport adapters, and Control Board. •Replace drive, if required. If you do not want this condition to be reported as a fault, change bit 9 in *Fault Select 1* (parameter 20) to 0.
06042 *SP 2 Timeout*	VP, Flashing red	Soft	The SCANport adapter at port 2 has been disconnected and the logic mask bit for port 2 is set (1).	If the adapter was not intentionally disconnected: •Check the wiring to the SCANport adapters. •Replace wiring, SCANport expander, SCANport adapters, and Control Board. •Replace drive, if required. If you do not want this condition to be reported as a fault, change bit 10 in *Fault Select 1* (parameter 20) to 0.
06043 *SP 3 Timeout*	VP, Flashing red	Soft	The SCANport adapter at port 3 has been disconnected and the logic mask bit for port 3 is set (1).	If the adapter was not intentionally disconnected: •Check the wiring to the SCANport adapters. •Replace wiring, SCANport expander, SCANport adapters, and Control Board. •Replace drive, if required. If you do not want this condition to be reported as a fault, change bit 11 in *Fault Select 1* (parameter 20) to 0.
06044 *SP 4 Timeout*	VP, Flashing red	Soft	The SCANport adapter at port 4 has been disconnected and the logic mask bit for port 4 is set (1).	If the adapter was not intentionally disconnected: •Check the wiring to the SCANport adapters. •Replace wiring, SCANport expander, SCANport adapters, and Control Board. •Replace drive, if required. If you do not want this condition to be reported as a fault, change bit 12 in *Fault Select 1* (parameter 20) to 0.

Fault Code and Text	LED Status	Fault Type	Description	Suggested Action
06045 *SP 5 Timeout*	VP, Flashing red	Soft	The SCANport adapter at port 5 has been disconnected and the logic mask bit for port 5 is set (1).	If the adapter was not intentionally disconnected: • Check the wiring to the SCANport adapters. • Replace wiring, SCANport expander, SCANport adapters, and Control Board. • Replace drive, if required. If you do not want this condition to be reported as a fault, change bit 13 in *Fault Select 1* (parameter 20) to 0.
06046 *SP 6 Timeout*	VP, Flashing red	Soft	The SCANport adapter at port 6 has been disconnected and the logic mask bit for port 6 is set (1).	If the adapter was not intentionally disconnected: • Check the wiring to the SCANport adapters. • Replace wiring, SCANport expander, SCANport adapters, and Control Board. • Replace drive, if required. If you do not want this condition to be reported as a fault, change bit 14 in *Fault Select 1* (parameter 20) to 0.
06047 *SP Error*	VP, Flashing red	Soft	SCANport communications have been interrupted.	If the adapter was not intentionally disconnected: • Check for excessive electrical noise in the system. • Check the wiring to the SCANport adapters. • Replace wiring, SCANport expander, SCANport adapters, and Control Board. • Replace drive, if required. If you do not want this condition to be reported as a fault, change bit 15 in *Fault Select 1* (parameter 20) to 0.
06073 *SP 1 Timeout*	VP, Flashing green	Warning	The SCANport adapter at port 1 has been disconnected and the logic mask bit for port 1 is set (1).	If the adapter was not intentionally disconnected: • Check the wiring to the SCANport adapters. • Replace wiring, SCANport expander, SCANport adapters, and Control Board. • Replace drive, if required. If you do not want this condition to be reported as a warning, change bit 9 in *Warning Select 1* (parameter 21) to 0.
06074 *SP 2 Timeout*	VP, Flashing green	Warning	The SCANport adapter at port 2 has been disconnected and the logic mask bit for port 2 is set (1).	If the adapter was not intentionally disconnected: • Check the wiring to the SCANport adapters. • Replace wiring, SCANport expander, SCANport adapters, and Control Board. • Replace drive, if required. If you do not want this condition to be reported as a warning, change bit 10 in *Warning Select 1* (parameter 21) to 0.

Fault Code and Text	LED Status	Fault Type	Description	Suggested Action
06075 *SP 3 Timeout*	VP, Flashing green	Warning	The SCANport adapter at port 3 has been disconnected and the logic mask bit for port 3 is set (1).	If the adapter was not intentionally disconnected: • Check the wiring to the SCANport adapters. • Replace wiring, SCANport expander, SCANport adapters, and Control Board. • Replace drive, if required. If you do not want this condition to be reported as a warning, change bit 11 in *Warning Select 1* (parameter 21) to 0.
06076 *SP 4 Timeout*	VP, Flashing green	Warning	The SCANport adapter at port 4 has been disconnected and the logic mask bit for port 4 is set (1).	If the adapter was not intentionally disconnected: • Check the wiring to the SCANport adapters. • Replace wiring, SCANport expander, SCANport adapters, and Control Board. • Replace drive, if required. If you do not want this condition to be reported as a warning, change bit 12 in *Warning Select 1* (parameter 21) to 0.
06077 *SP 5 Timeout*	VP, Flashing green	Warning	The SCANport adapter at port 5 has been disconnected and the logic mask bit for port 5 is set (1).	If the adapter was not intentionally disconnected: • Check the wiring to the SCANport adapters. • Replace wiring, SCANport expander, SCANport adapters, and Control Board. • Replace drive, if required. If you do not want this condition to be reported as a warning, change bit 13 in *Warning Select 1* (parameter 21) to 0.
06078 *SP 6 Timeout*	VP, Flashing green	Warning	The SCANport adapter at port 6 has been disconnected and the logic mask bit for port 6 is set (1).	If the adapter was not intentionally disconnected: • Check the wiring to the SCANport adapters. • Replace wiring, SCANport expander, SCANport adapters, and Control Board. • Replace drive, if required. If you do not want this condition to be reported as a warning, change bit 14 in *Warning Select 1* (parameter 21) to 0.
06079 *SP Error*	VP, Flashing green	Warning	SCANport communications have been interrupted.	If the adapter was not intentionally disconnected: • Check for excessive electrical noise in the system. • Check the wiring to the SCANport adapters. • Replace wiring, SCANport expander, SCANport adapters, and Control Board. • Replace drive, if required. If you do not want this condition to be reported as a warning, change bit 15 in *Warning Select 1* (parameter 21) to 0.

Fault Code and Text	LED Status	Fault Type	Description	Suggested Action
12016 *Overvoltage*	CP, Solid red	Soft	The DC bus voltage has exceeded the maximum value. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Monitor the AC line for high line voltage or transient conditions. Increase the deceleration time or install the dynamic brake option because motor regeneration can also cause bus overvoltages. Refer to the user manual for a description of *Bus Options* (parameter 13) for additional information about bus overvoltages. If you are using flux braking, refer to Chapter 9, *Applications*, in the user manual for information about flux braking.
12017 *Desaturation*	CP, Solid red	Soft	There was too much current in the system. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Run the power structure diagnostics. Check for a shorted motor or motor wiring. Replace the drive.
12018 *Ground Fault*	CP, Solid red	Soft	A current path to earth ground in excess of drive rated current has been detected at one or more of the drive output terminals. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Run the power structure diagnostics. Check the motor and external wiring to the drive output terminals for a grounded condition. On the Precharge Board Mounting Frame, check the power supply and relay R1. Replace the drive.
12019 *Overcurrent*	CP, Solid red	Soft	There was too much current in the system. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Run the power structure diagnostics. Check for shorted motor or motor wiring. Replace drive.
12020	CP, Solid red	Soft	VP and CP have lost communication.	Cycle power to drive. Reset defaults. Replace Control Board.
12032 *RidethruTime*	CP, Flashing red	Soft	There was a bus voltage drop of 150V and power did not return within 2 seconds.	Check the incoming power and fuses. Refer to the *Understanding Precharge and Ridethrough Faults* section in the troubleshooting chapter of the user manual for more information. If you do not want this condition to be reported as a fault, change bit 0 in *Fault Select 1* (parameter 20) to 0.

Fault Code and Text	LED Status	Fault Type	Description	Suggested Action
12033 *Prechrg Time*	CP, Flashing red	Soft	The precharge function could not complete within 30 seconds.	Refer to the *Understanding Precharge and Ridethrough Faults* section in the troubleshooting chapter of the user manual for more information. If you do not want this condition to be reported as a fault, change bit 1 in *Fault Select 1* (parameter 20) to 0.
12034 *Bus Drop*	CP, Flashing red	Soft	The bus voltage dropped 150V below the bus tracker voltage.	Monitor the incoming AC line for low voltage or line power interruption. Refer to the *Understanding Precharge and Ridethrough Faults* section in the troubleshooting chapter of the user manual for more information. If you do not want this condition to be reported as a fault, change bit 2 in *Fault Select 1* (parameter 20) to 0.
12035 *Bus Undervlt*	CP, Flashing red	Soft	The DC bus voltage fell below the trip value (388V DC at 460V AC input).	Monitor the incoming AC line for low voltage or line power interruption. Refer to the *Understanding Precharge and Ridethrough Faults* section in the troubleshooting chapter of the user manual for more information. If you do not want this condition to be reported as a fault, change bit 3 in *Fault Select 1* (parameter 20) to 0 or decrease the bus undervoltage setpoint.
12036 *Bus Cycle>5*	CP, Flashing red	Soft	At least 5 ridethrough cycles have occurred within a 20 second period. This indicates a converter problem or a problem with the incoming power.	Monitor the incoming AC line for low voltage or line power interruption. Refer to the *Understanding Precharge and Ridethrough Faults* section in the troubleshooting chapter of the user manual for more information. If you do not want this condition to be reported as a fault, change bit 4 in *Fault Select 1* (parameter 20) to 0.
12037 *Open Circuit*	CP, Flashing red	Soft	The fast flux up current is less than 50% of commanded.	Make sure the motor is properly connected. Refer to the *Understanding Precharge and Ridethrough Faults* section in the troubleshooting chapter of the user manual for more information. If you do not want this condition to be reported as a fault, change bit 5 in *Fault Select 1* (parameter 20) to 0.

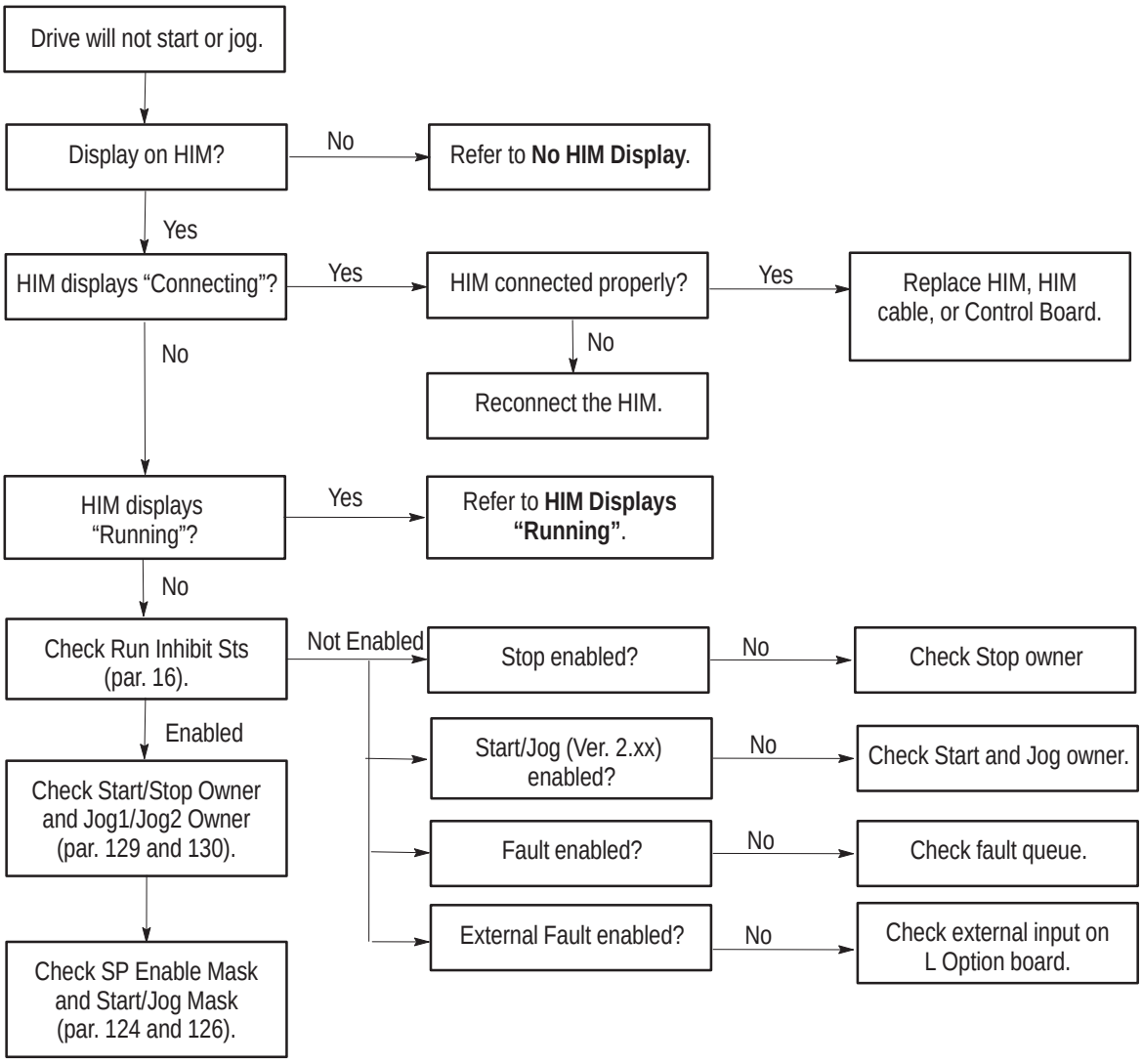
Fault Code and Text	LED Status	Fault Type	Description	Suggested Action
12064 *RidethruTime*	CP, Solid green	Warning	There was a drop of 150V and power did not return within 2 seconds.	Check the incoming power and fuses. Refer to the *Understanding Precharge and Ridethrough Faults* section in the troubleshooting chapter of the user manual for more information. If you do not want this condition to be reported as a warning, change bit 0 in *Warning Select 1* (parameter 21) to 0.
12065 *Prechrg Time*	CP, Solid green	Warning	The precharge function could not complete within 30 seconds.	Refer to the *Understanding Precharge and Ridethrough Faults* section in the troubleshooting chapter of the user manual for more information. If you do not want this condition to be reported as a warning, change bit 1 in *Warning Select 1* (parameter 21) to 0.
12066 *Bus Drop*	CP, Solid green	Warning	The bus voltage dropped 150V below the bus tracker voltage.	Monitor the incoming AC line for low voltage or line power interruption. Refer to the *Understanding Precharge and Ridethrough Faults* section in the troubleshooting chapter of the user manual for more information. If you do not want this condition to be reported as a warning, change bit 2 in *Warning Select 1* (parameter 21) to 0.
12067 *Bus Undervlt*	CP, Solid green	Warning	The DC bus voltage fell below the minimum value (388V DC at 460V AC input).	Monitor the incoming AC line for low voltage or line power interruption. Refer to the *Understanding Precharge and Ridethrough Faults* section in the troubleshooting chapter of the user manual for more information. If you do not want this condition to be reported as a warning, change bit 3 in *Warning Select 1* (parameter 21) to 0.
12068 *Bus Cycle>5*	CP, Solid green	Warning	At least 5 ridethrough cycles have occurred within a 20 second period. This indicates a converter problem or a problem with the incoming power.	Monitor the incoming AC line for low voltage or line power interruption. Refer to the *Understanding Precharge and Ridethrough Faults* section in the troubleshooting chapter of the user manual for more information. If you do not want this condition to be reported as a warning, change bit 4 in *Warning Select 1* (parameter 21) to 0.

Fault Code and Text	LED Status	Fault Type	Description	Suggested Action
12069 *Open Circuit*	CP, Solid green	Warning	The fast flux up current is less than 50% of commanded.	Make sure the motor is properly connected. Refer to the *Understanding Precharge and Ridethrough Faults* section in the troubleshooting chapter of the user manual for more information. If you do not want this condition to be reported as a warning, change bit 5 in *Warning Select 1* (parameter 21) to 0.
13000 *HW Malfunction*	CP, Solid red	Hard	A hardware malfunction occurred.	Recycle the power. If the fault does not clear, replace the Control Board.
13001 *HW Malfunction*	CP, Solid red	Hard	A hardware malfunction occurred.	Recycle the power. If the fault does not clear, replace the Control Board.
13002 *HW Malfunction*	CP, Solid red	Hard	A hardware malfunction occurred.	Recycle the power. If the fault does not clear, replace the Control Board.
13003 *HW Malfunction*	CP, Solid red	Hard	A hardware malfunction occurred.	Recycle the power. If the fault does not clear, replace the Control Board.
13004 *HW Malfunction*	CP, Solid red	Hard	A hardware malfunction occurred.	Recycle the power. If the fault does not clear, replace the Control Board.

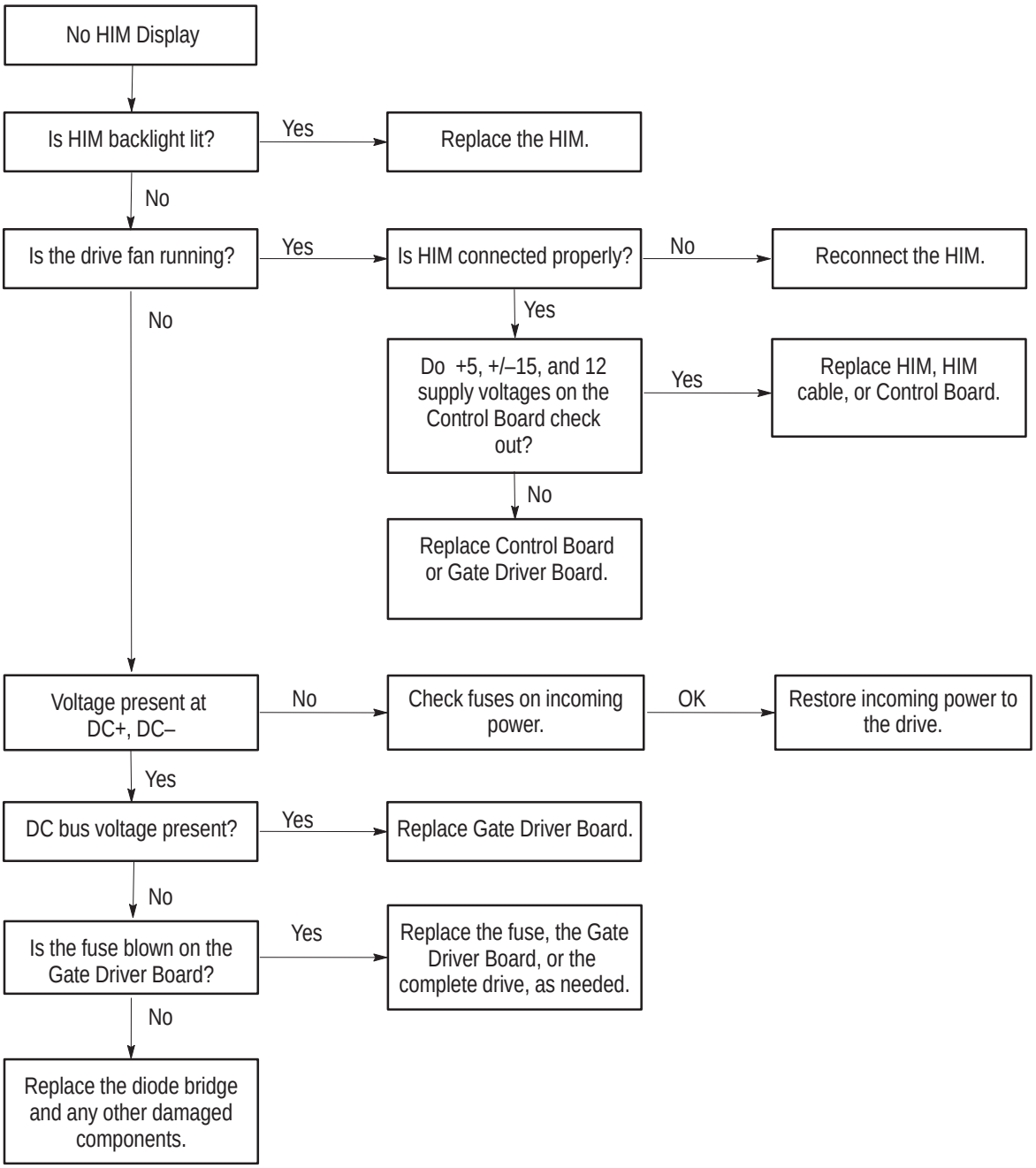
Diagnostic Procedures by Symptom

The following charts list drive symptoms, symptom descriptions, and recommended actions.

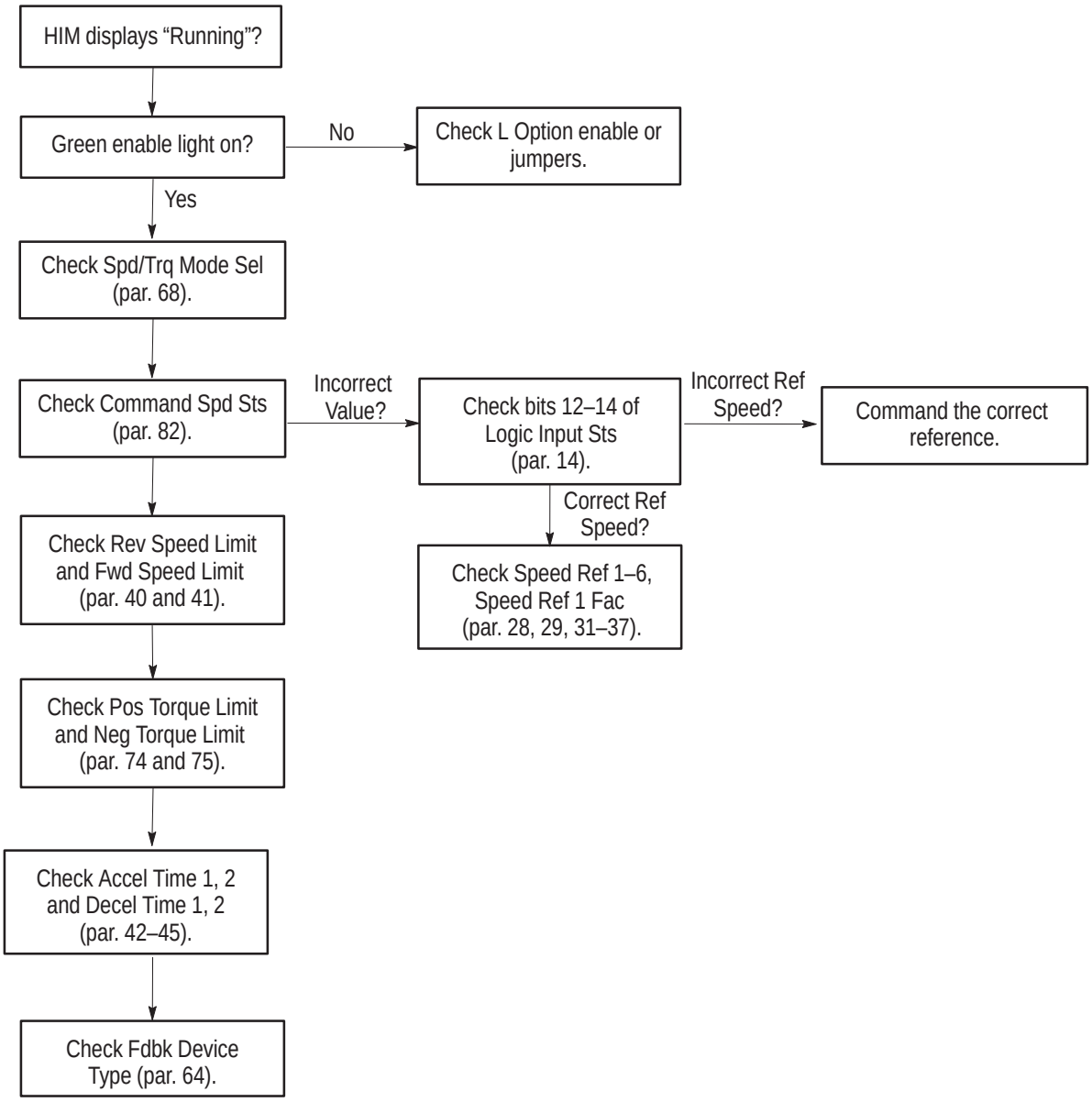
Drive Will Not Start or Jog



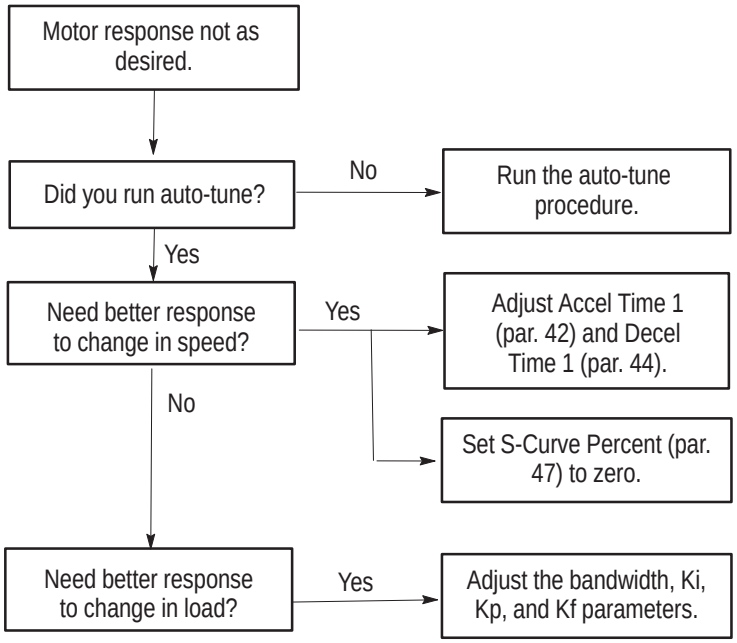
No HIM Display



HIM Displays “Running”


HIM displays “Running”?
Green enable light on?
No
Check L Option enable or jumpers.
Yes
Check Spd/Trq Mode Sel (par. 68).
Check Command Spd Sts (par. 82).
Incorrect Value?
Check bits 12–14 of Logic Input Sts (par. 14).
Incorrect Ref Speed?
Command the correct reference.
Correct Ref Speed?
Check Speed Ref 1–6, Speed Ref 1 Fac (par. 28, 29, 31–37).
Check Rev Speed Limit and Fwd Speed Limit (par. 40 and 41).
Check Pos Torque Limit and Neg Torque Limit (par. 74 and 75).
Check Accel Time 1, 2 and Decel Time 1, 2 (par. 42–45).
Check Fdbk Device Type (par. 64).

Motor Response Not As Desired


Motor response not as desired.
Did you run auto-tune?
No
Run the auto-tune procedure.
Yes
Need better response to change in speed?
Yes
Adjust Accel Time 1 (par. 42) and Decel Time 1 (par. 44).
No
Set S-Curve Percent (par. 47) to zero.
Need better response to change in load?
Yes
Adjust the bandwidth, Ki, Kp, and Kf parameters.

Start Up Troubleshooting Procedures

If you are having problems with the start up procedure, refer to this table for possible solutions before calling for help.

If:	Then:
You powered up your drive and cannot access the start up routine.	The start up procedure is not supported on a Series A Human Interface Module (HIM). To verify that you have a Series A HIM, check the series letter located on the back side of the HIM or check the HIM version when you first power up your drive.
You got a *Feedback Loss Fault*.	You have specified that an encoder is on the system but it has been disconnected.
The motor does not turn during the phase rotation test.	Remove the load from the motor and try running the autotune tests again. Afterwards, you will need to attach the load again and run the inertia test manually.

During the phase rotation test you were asked to swap the encoder leads. And, after you changed the leads and repeated the start up, you were again asked to swap the leads.	The drive is not getting any speed feedback information. You need to:
	• Check the connection between the encoder and the motor.
	• Run the phase rotation test again and escape out to the status display at the first question. Check the motor speed. It should ramp to 3 Hz (90 rpm) for a 60 Hz 4 pole motor. If the motor speed is 0 rpm, you should:
	  • Check the encoder wiring.
	  • Check the encoder itself.

Miscellaneous Troubleshooting Procedures

If you are having problems with how your 1336 IMPACT drive is operating, refer to this table for possible solutions before calling for help.

If:	Then you should:
The drive starts and then stops.	• Check if the mode specified in *L Option Mode* (parameter 116) is 2 or 3 wire. • Check *SP 2 Wire Enable* (parameter 181). • Check to see if the HIM displays a fault message. • Check the L Option Board wiring. • Check the settings on your gateway (communications module).
There is a delay before the stop command takes effect.	• Check the value of *Stop Dwell Time* (parameter 18).
The motor waits before starting.	• Check *Start Dwell Time* (parameter 194). • Check *Pos Torque Lim* (parameter 74) and *Neg Torque Lim* (parameter 75). • Check *Fast Flux Level* (parameter 78) and bit 8 of *Bus/Brake Opts* (parameter 13). • Check *S-Curve Percent* (parameter 47).
The drive coasts on stop.	• Check the stop type bits in *Logic Options* (parameter 17). • Check *Zero Speed Tol* (parameter 19).
You cannot clear faults.	• Check if the port is enabled in *SP Enable Mask* (parameter 124). • Check if clear faults is enabled in *Clr Flt/Res Mask* (parameter 127). • Check if clear fault owners in *Ramp/ClFlt Owner* (parameter 131) is set. If set, check stop owners in *Start/Stop Owner* (parameter 129) and remove stop conditions. • The fault is a hard fault which requires a power cycle or drive reset.

If:	Then you should:
The motor does not turn or run at the correct speed.	• Check which speed reference the drive is following in *Drive/Inv Status* (parameter 21) bits 13–15. • Check if *Spd/Trq Mode Sel* (parameter 68) is set correctly. • Check if *Spd Desired BW* (parameter 161) is non-zero. • Set the drive defaults and run start up again to tune the drive.
The HIM pot does not control motor speed.	• Check if *SP An In1 Select* (parameter 133) or *SP An In2 Select* (parameter 136) is set to the HIM port number. • Check if *SP An In1 Scale* (parameter 135) or *SP An In2 Scale* (parameter 138) is 0.125. • Check if a *Speed Ref 1–7* (parameters 29 through 36) is linked to *SP An In1 Value* (parameter 134) or *SP An In2 Value* (parameter 137). • Check which speed reference the drive is following in *Drive/Inv Status* (parameter 21) bits 13–15. The speed reference should be set to the speed reference that *SP An In1 Value* (parameter 134) or *SP An In2 Value* (parameter 137) is linked to.
The drive will not change direction.	• Check if the port is enabled in *SP Enable Mask* (parameter 124). • Check if Direction is enabled in *Dir/Ref Mask* (parameter 125). • Check if Direction owner in *Dir/Ref Owner* (parameter 128) has any bit set. If so, remove the command direction. • Check to make sure that bit 11 in *Logic Options* (parameter 17) is clear (0).

You cannot change the speed reference.	• Check if the port is enabled in *SP Enable Mask* (parameter 124).
	• Check if Reference is enabled in *Dir/Ref Mask* (parameter 125).
	• Check if Reference owner in *Dir/Ref Owner* (parameter 128) has any bit set. If so, remove the command reference. If bit 0 (for the L Option control) is set, you need to do one of the following to remove ownership:
	  • Clear bit 0 in *Dir/Ref Mask* (parameter 125):
	  • If *L Option Mode* (parameter 116) is 2, 3, 8, 9, 23, 24, or 26, close the L Option inputs for speed references 1, 2, and 3.

The drive does not run correct torque.	• Set the drive defaults and run start up again to tune the drive. • Check *Spd/Trq Mode Sel* (parameter 68) and *Slave Torque %* (parameter 70).
The drive cannot control current and trips on an overcurrent fault.	• If you are using an encoder, check that you have entered the correct PPR into *Encoder PPR* (parameter 8).
The MOP does not work.	• Check *L Option Mode* (parameter 116). • Make sure that *Mop Value* (parameter 119) is linked to a speed reference.
The pulse input does not work.	• Make sure that the pulse input jumper is set correctly. • Make sure that the input is differential and not single ended. • Check the values of *Pulse In PPR* (parameter 120), *Pulse In Scale* (parameter 121), and *Pulse In Offset* (parameter 122). • Check the link on *Pulse In Value* (parameter 123).
The external fault does not work.	• Check the mode in *L Option Mode* (parameter 116). • Check bit 6 in *Fault Select 2* (parameter 22) and *Warning Select 2* (parameter 23).
You keep getting motor overload trips.	• Reduce the load. • Check bits 3 and 4 in *Fault Select 2* (parameter 22) and *Warning Select 2* (parameter 23). • Check *Motor Overload %* (parameter 26).

If:	Then you should:
The motor reduced the speed range.	• Check *SP An In1 Scale* (parameter 135) or *SP An In2Scale* (parameter 138) if your speed input is coming from the HIM pot. • Check *An In 1 Offset* (parameter 97), *An In 1 Scale* (parameter 98), *An In 2 Offset* (parameter 100), *An In 2 Scale* (parameter 101), *mA Input Offset* (parameter 103), and *mA Input Scale* (parameter 104) if your speed input is coming from the analog inputs. • Check *Speed Scale 1* (parameter 30) or *Speed Scale 7* (parameter 37). • Check *Absolute Overspd* (parameter 24). • Check *Min Speed Limit* (parameter 215).

Encoderless Troubleshooting Procedures

If you are having problems with encoderless mode, refer to this table for possible solutions before calling for help.

If:	Then you should:
The motor will not accelerate or does not start smoothly.	• Increase the bandwidth in *Spd Desired BW* (parameter 161). If the bandwidth is too low, the motor may not accelerate, although the current increases to current limit. • If the regen power limit is 0, increase it to at least –5%. • Increase the torque and current limits to the maximum. • Increase the value of *Kp Freq Reg* (parameter 178).
The motor oscillates after it is up to speed.	• Decrease the bandwidth in *Spd Desired BW* (parameter 161) if the process will allow. If this does not help, depending on your application, you need to either increase or decrease the value of *Error Filter BW* (parameter 162).
The inverter trips on absolute overspeed during starting.	• Increase the acceleration time. • If the overspeed occurs during a fast acceleration, increase the value of *Kp Freq Reg* (parameter 178) until the trip stops occurring. • Increase the bandwidth in *Spd Desired BW* (parameter 161). • If the overspeed occurs during a reversal, increase the deceleration time (slower deceleration).

Access Procedures

Chapter Objectives

This chapter describes general disassembly procedures required to access internal drive components for testing or repair.

Access Overview

ATTENTION: Some printed circuit boards and drive components may contain hazardous voltage levels. Remove and lock out power before you disconnect or reconnect wires, and before you remove or replace fuses and circuit boards. Verify bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three bus fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Servicing energized industrial control equipment can be hazardous. Electrical shock, burns, or unintentional actuation of controlled industrial equipment may cause death or serious injury. Follow the safety-related practices of NFPA 70E, *Electrical Safety for Employee Workplaces*, when working on or near energized equipment. Do not work alone on energized equipment.

Electrostatic Discharge Precautions

ATTENTION: This assembly contains parts and sub-assemblies that are sensitive to electrostatic discharge. Static control precautions are required when servicing this assembly. Component damage may result if you ignore electrostatic discharge control procedures. If you are not familiar with static control procedures, reference Rockwell Automation Publication 8000-4.5.2, *Guarding Against Electrostatic Discharge*, or any other applicable ESD protection handbook.

Electrostatic discharge generated by static electricity can damage the complementary metallic oxide semiconductor devices on various drive boards. It is recommended that you perform these procedures to guard against this type of damage when circuit boards are removed or installed:

- Wear a wrist-type grounding strap that is grounded to the chassis.
- Attach the wrist strap before removing the new circuit board from the conductive packet.
- Remove boards from the drive and immediately insert them into their conductive packets.

Tools

You need the following tools to disassemble and assemble the drive:

- Pliers
- Phillips screwdrivers (small, medium, and large)
- Standard screwdrivers (small, medium, and large)
- Metric socket set up to 19 mm
- Torque wrench to 32 N-m or 280 in.-lbs
- Torque screwdriver to 9 N-m or 80 in.-lbs
- Nylon tie wraps

Fastener Torque Specifications

Torque Sequence

When mounting components to a drive's heat sink, component-fastener torque sequences and tolerances are crucial to component-to-heat sink heat dissipation.

ATTENTION: Component can be damaged if temporary tightening procedure is not performed to specification.

The following illustrates temporary and final tightening sequences for components fastened to a heat sink using two, four, and six screws. Temporary torque is 1/3 (33%) of final torque, except six-point mountings, which require 0.5 N-m (4 in.-lb). The numeric illustration labels are for your assistance. Drive components do not carry these labels.

Figure 3.1
Two-Point Mounting

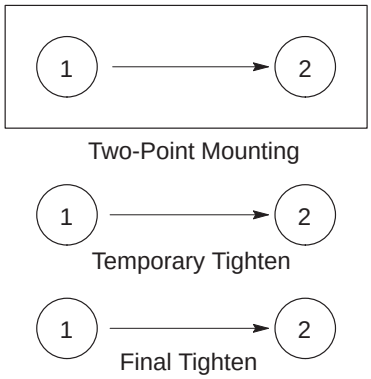


Figure 3.2
Four-Point Mounting

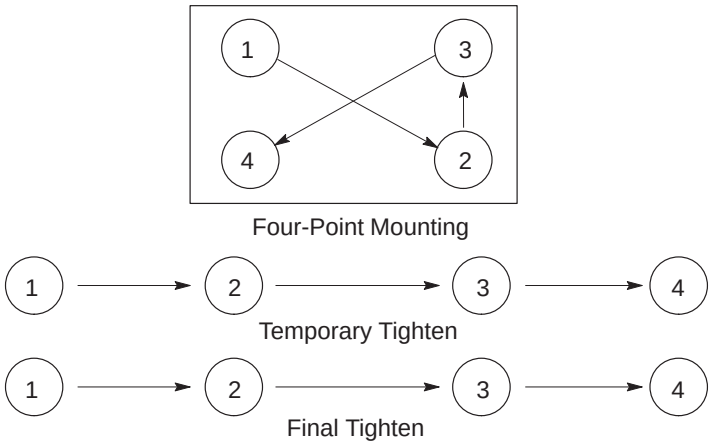
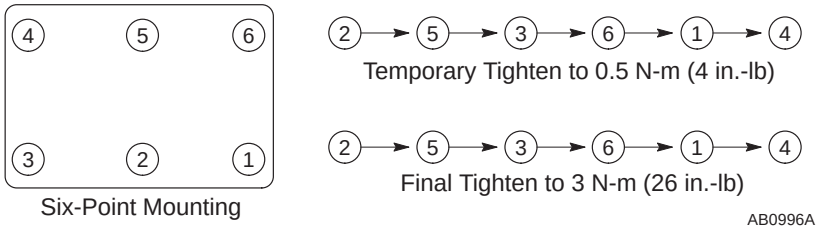


Figure 3.3
Six-Point Mounting



Do not exceed 0.4 N-m (3 in.-lb) on initial torque or 3.8 N-m (32 in.-lb) final torque of all six screws.

Torque Specifications

The following table lists fastener locations by component, how the fasteners are used, and torque specifications. Refer to Torque Sequence in this chapter for fastening two-point, four-point and six-point components to the heat sink.

Table 3.A
Fastener Torque Specifications

Component	Fastener Application	Torque in.-lb	Torque N-m
Fan Motor	Motor to Fan Cover Assembly	14	1.6
Snubber Resistor	Resistor to heat sink	26	2.9
Snubber Bracket	Bracket to Power Module Laminated Bus	90	10
Snubber Board	Board to Brackets	18	2.0
Snubber Board	Board to Input Rectifier Bracket	18	2.0
Volt-Sharing Resistor	Resistor to heat sink	26	2.9
Volt-Sharing Resistor	Wires to Capacitor Bus Bar Assembly	50	5.6
Thermistor	Thermistor to heat sink	14	1.6

Component	Fastener Application	Torque in.-lb	Torque N-m
Thermostat	Thermostat to heat sink	14	1.6
Bus Capacitor Holder	Holder to Bus Capacitors	26	2.9
Capacitor Bus Bar Assembly	Assembly to Bus Capacitors	50	5.6
Power Module Gate Interface Board	Board to Power Modules	18	2.0
Power Module Bus Bar	Bus Bar to Power Modules	90	10
Power Module	Module to heat sink	Refer to Figure 3.3	
SCR and Diode	SCR or Diode to heat sink	Refer to Note 1	
SCR and Diode Assembly	Clamp nuts	240	27
SCR and Diode Assembly	Heat sink to Back-up Plate	75	8.5
SCR and Diode Assembly	Back-up Plate to Inverter Assembly	75	8.5
SCR and Diode Assembly	U-shaped Bus Bar to Inverter Assembly	240	27
SCR and Diode Assembly	Square Bus Bar Plate to Inverter Assembly	240	27
SCR and Diode Assembly	HV Guard to SCR and Diode Assembly	26	2.9
Transitional Bus Bar Assembly	Assembly to Power Module Bus Bar Assembly	80	9.0
Bus Fuse F1 – F3	Fuse to Transitional Bus Bar Assembly	240	27
DC Bus Inductor L1	Inductor to chassis	75	8.5
Bus Bar Cable Adaptor	Adaptor to Transitional Bus Bar Assembly and DC Bus Inductor, right side of Motor Flex Bus	75	8.5
Converter Bus and Motor Bus Bars	All connections	240	27
Wires (PE)	Wires to Ground Stud	175	20
Wire (TE)	Wire on Control Board Mounting Plate	26	2.9
Wires	Wires to TB1	16	1.8
Wires	Wires to TB2	7	0.8
Wires	Wires to TB3	8 – 10	0.9 – 1.1
Power Cables	Cables to terminals	240	27
Control, Gate Driver, Common Bus Precharge Board Mounting Plates	Plates to chassis	26	2.9
Heat Sink Guard	Guard to chassis	18	2.0
T-Bar Mounting Bolt	T-Bar to Main Frame	240	27
Capacitor Mounting Bolt	Capacitor Bank Assembly to Main Frame	240	27
Inverter Housing Assembly Lock-Down Bolt	Inverter Housing Assembly to Main Frame	240	27
Wheel Chock Fasteners	Wheel Chocks to tracks	75	8.5
Ground Cable Bolts	Ground Cables from both assemblies to Main Frame	75	8.5
Converter Bay Fuses (F1, F1A, etc.)	Fuse to bus	445	50
Converter Diodes	Converter Diode to heat sink	50	5.6
Converter Bay Thermal Switches	Thermal Switch to heat sink	16	1.8
Converter Bus Bars	L-shaped Bus Bar to Diode and bus bar interconnections	90	10
Converter Fans	Fan to heat sink	12	1.4

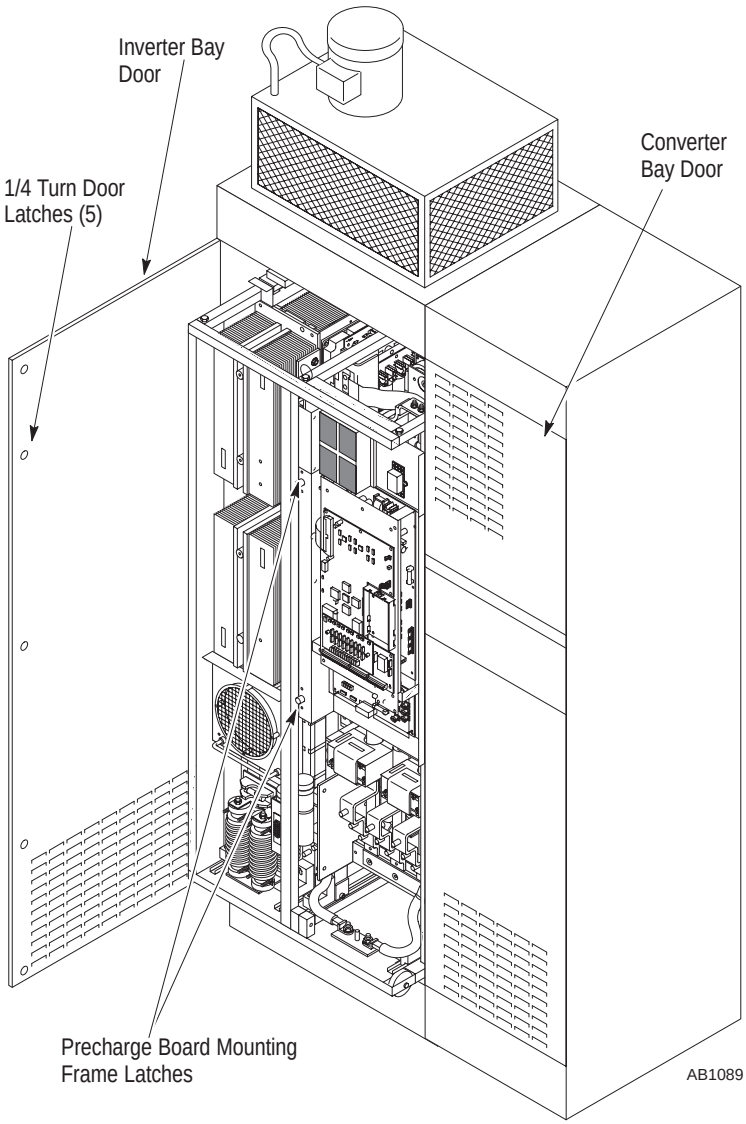
[1] Refer to the gauge on the clamp, which indicates pounds of force. The reading should be 400 lbs.

Access Procedures

Opening the Drive Enclosure

Follow all steps in this procedure whenever you open the drive cabinet.

Figure 3.4
Drive Enclosure



Opening

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to *Electrostatic Discharge Precautions* at the beginning of this chapter.

1. Remove power from the drive, including all remote power sources.

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury.

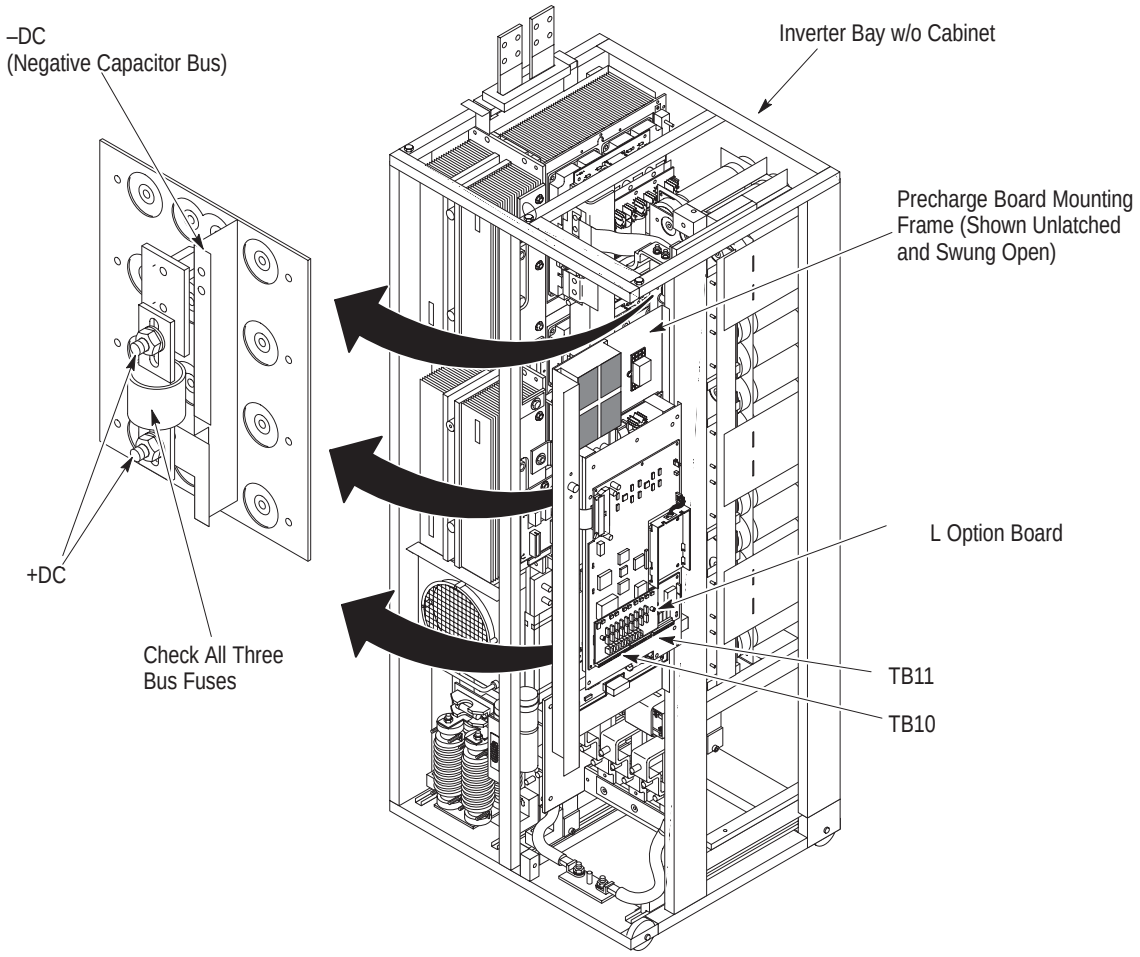
2. Turn the Inverter Bay door latches 1/4 turn counterclockwise to open the enclosure door.
3. Turn the latches, located on the left side of the Precharge Board Mounting frame, to open the Precharge Board Mounting Frame. Refer to Figure 3.4.
4. Check for zero volts between +DC and –DC. Refer to Figure 3.5.

ATTENTION: Verify zero bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three bus fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: A blown fuse can create a hazard of shock which may result in death or serious injury. Check voltage between the bus bar and both ends of all three fuses.

5. Refer to Figure 3.5. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)

Figure 3.5
No Voltage Check



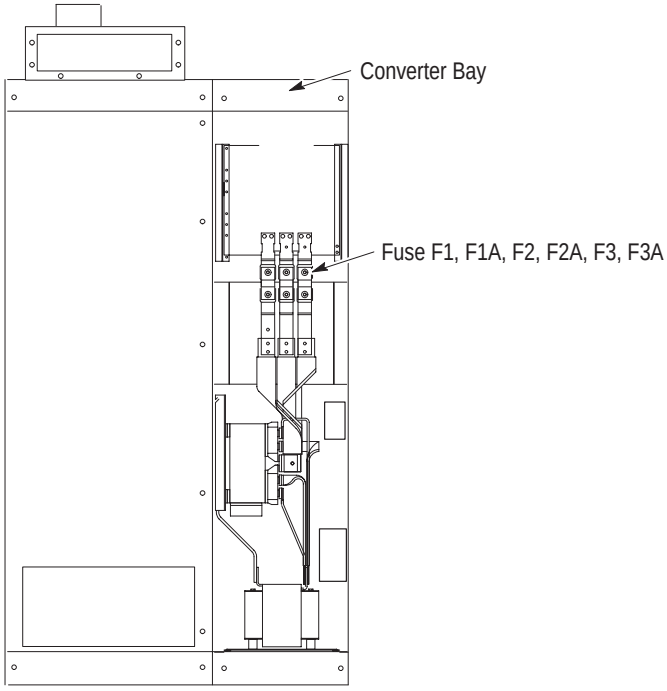
6. Typically, the Converter Bay door opens with quarter turn latches. Also, if present, pull the:

- Circuit breaker handle all the way down
- Rotary disconnect handle to Off

7. Check for zero volts on incoming power lines. In particular at the six line fuses, check both ends for zero voltage from phase to phase and phase to ground. Refer to Figure 3.6.

ATTENTION: A blown fuse can create a hazard of shock which may result in death or serious injury. Check voltage between the reference and both ends of all fuses.

Figure 3.6
Typical Check for No Incoming Voltage



Closing the Drive Enclosure

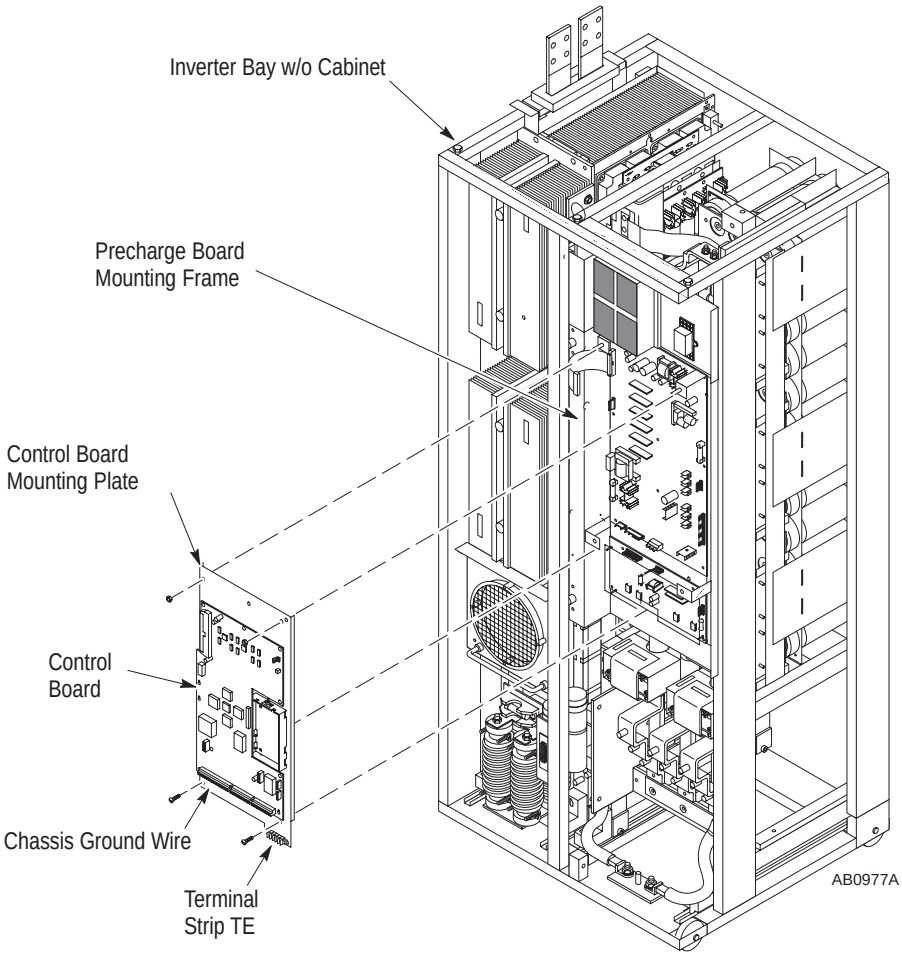
ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

1. If open, close and latch the Precharge Board Mounting Frame.
2. Close the Inverter Bay door and latch with quarter turn latches.
3. Close the Converter Bay door and latch with quarter turn latches.

Removing the Control Board Mounting Plate

The Control Board Mounting Plate must be removed to access the Gate Driver Board, the Common Bus Precharge Board, and to remove the Precharge Board Mounting Frame.

Figure 3.7
Control Board and Mounting Plate



Removal

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to *Electrostatic Discharge Precautions* at the beginning of this chapter.

1. Referring to *Opening the Drive Enclosure* in this chapter, remove power and check for zero voltage in the drive.

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify zero bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three bus fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

2. Remove connectors and wires from the Control Board.
3. Remove the screws and nuts (two each) fastening the Control Board Mounting Plate to the Precharge Board Mounting Frame.
4. Grip the right and left sides of the Control Board Mounting Plate and pull straight out.

Installation

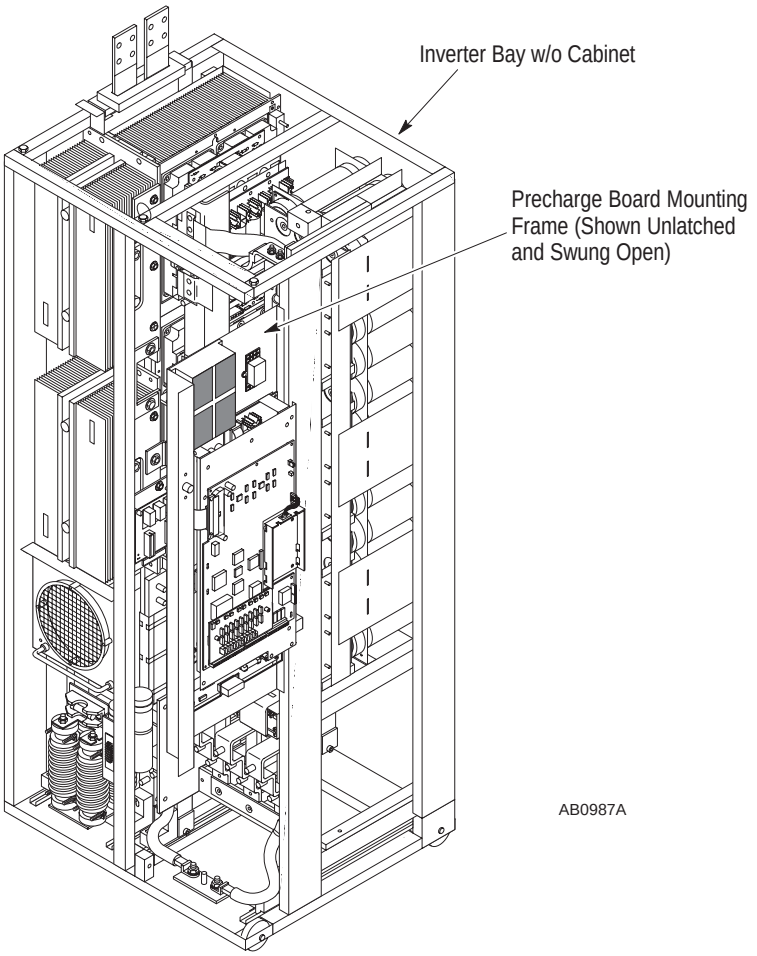
Install the Control Board Mounting Plate in reverse order of removal. Refer to Table 3.A – *Fastener Torque Specifications*.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Removing the Precharge Board Mounting Frame

The Precharge Board Mounting Frame must be removed to access the Capacitor Bank, the Power Modules, and the Current Transducers. And, must be removed before pulling the Inverter Assembly or Capacitor Bank Assembly.

Figure 3.8
Precharge Board Mounting Frame



Removal

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to *Electrostatic Discharge Precautions* at the beginning of this chapter.

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify zero bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three bus fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Perform the following procedures found earlier in this chapter:
   - *Opening the Drive Enclosure*
   - *Removing the Control Board Mounting Plate*
2. Disconnect all remaining wires connecting components on the Precharge Board Mounting Frame to any other assembly.
3. Open the Precharge Board Mounting Frame all the way to the right.
4. Lift the frame straight up to remove it from the hinges.

Installation

Install the Precharge Board Mounting Frame in reverse order of removal.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Removing the Motor Buses

The Motor Buses must be removed to access the Bus Capacitor Bank and the Current Transducers (or “LEMs”).

Removal

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to *Electrostatic Discharge Precautions* at the beginning of this chapter.

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify zero bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three bus fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

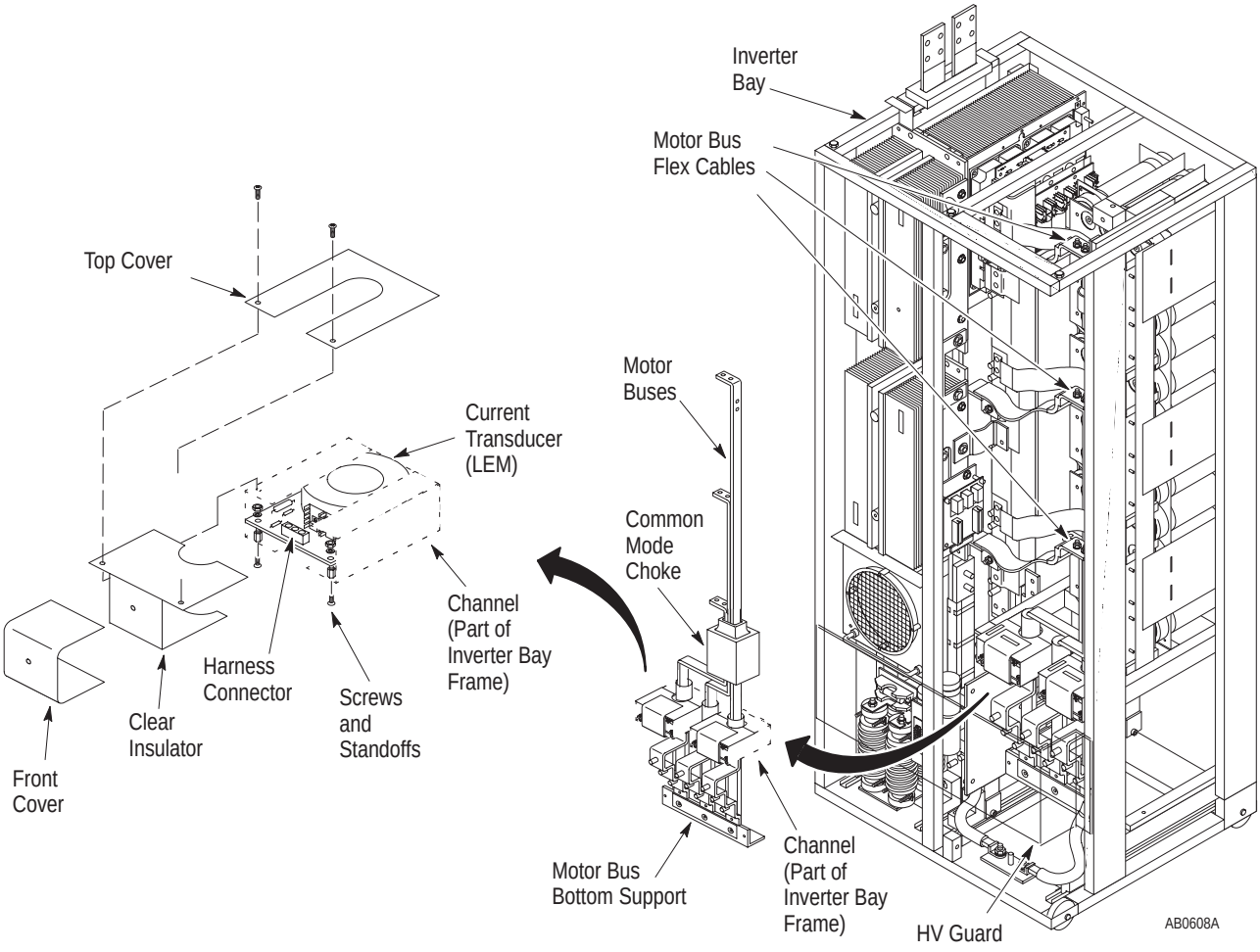
1. Perform the following procedures found earlier in this chapter:
   - *Opening the Drive Enclosure*
   - *Removing the Control Board Mounting Plate*
   - *Removing the Precharge Board Mounting Frame*
2. Remove the HV Guard that spans the bottom of the Inverter Bay (held in place with hook-and-loop strips).

Referring to Figure 3.9 and the following steps, loosen the Current Transducers:

1. Remove the two screws fastening the Top Cover on both Current Transducers.
2. Slide the Top Covers back out of the way.
3. Remove the Front Cover and Clear Insulator.
4. Remove the harness connected to each Current Transducer.

5. Remove the screws and standoffs fastening each Current Transducer to the channels on the bay frame.

Figure 3.9
Current Transducers



Referring again to Figure 3.9 and to the following steps, remove the Motor Buses:

1. Disconnect the Motor Buses from the Motor Bus Bottom Support.
2. Remove Motor Bus Bottom Support.
3. Disconnect the right Motor Bus at its upper end.
4. Disconnect Motor Buses from flex cables. (This step is not required when Motor Buses are being removed to access the Current Transducers.)
5. Remove the Motor Buses (or tilt out the bottom to access the Current Transducers).

Important: The motor buses include a Common Mode Choke, which can only be replaced as part of the Motor Bus assembly.

Installation

Install the Motor Bus Bars in reverse order of removal. Refer to Table 3.A – *Fastener Torque Specifications* in this chapter.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Pulling the Capacitor Bank Assembly

The Capacitor Bank Assembly must be pulled out to access the Capacitor Bank.

The assembly has wheels that roll in tracks built into the base of the drive. Chocks bolted into the tracks prevent assembly movement. The drive itself also has wheels, built into the main framework of the drive.

Removal

ATTENTION: To remove the Capacitor Bank Assembly safely requires two persons. Attempting to remove either assembly by yourself may result in death or serious injury.

ATTENTION: The assembly weighs about 225 kg (500 pounds). Before you pull it from the drive, you must have a platform in place to hold the assembly. You cannot remove the assembly without a platform. The top of the platform must be even with the assembly's track. The platform must be strong enough to support the assembly and the personnel servicing the drive. Refer to Figure 3.16.

ATTENTION: Do not remove both the Inverter and the Capacitor Bank assemblies at the same time.

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify zero bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three bus fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

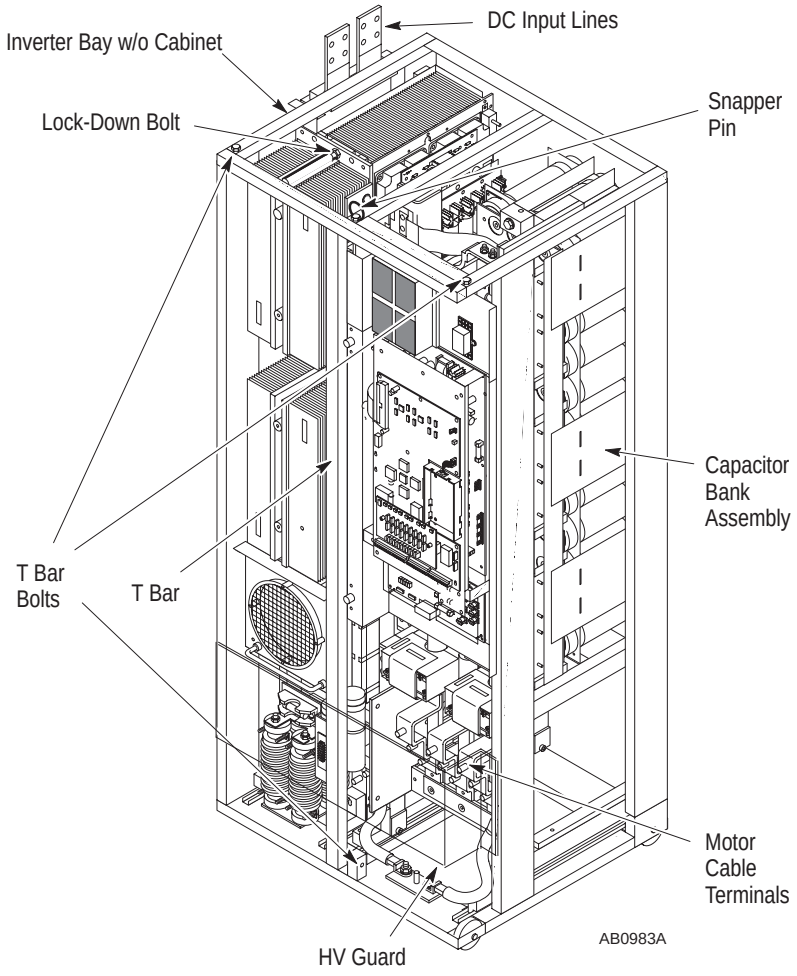
ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to *Electrostatic Discharge Precautions* at the beginning of this chapter.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Perform the following procedures found earlier in this chapter:

- *Opening the Drive Enclosure*
- *Removing the Control Board Mounting Plate*
- *Removing the Precharge Board Mounting Frame*

Figure 3.10
Capacitor Bank Assembly



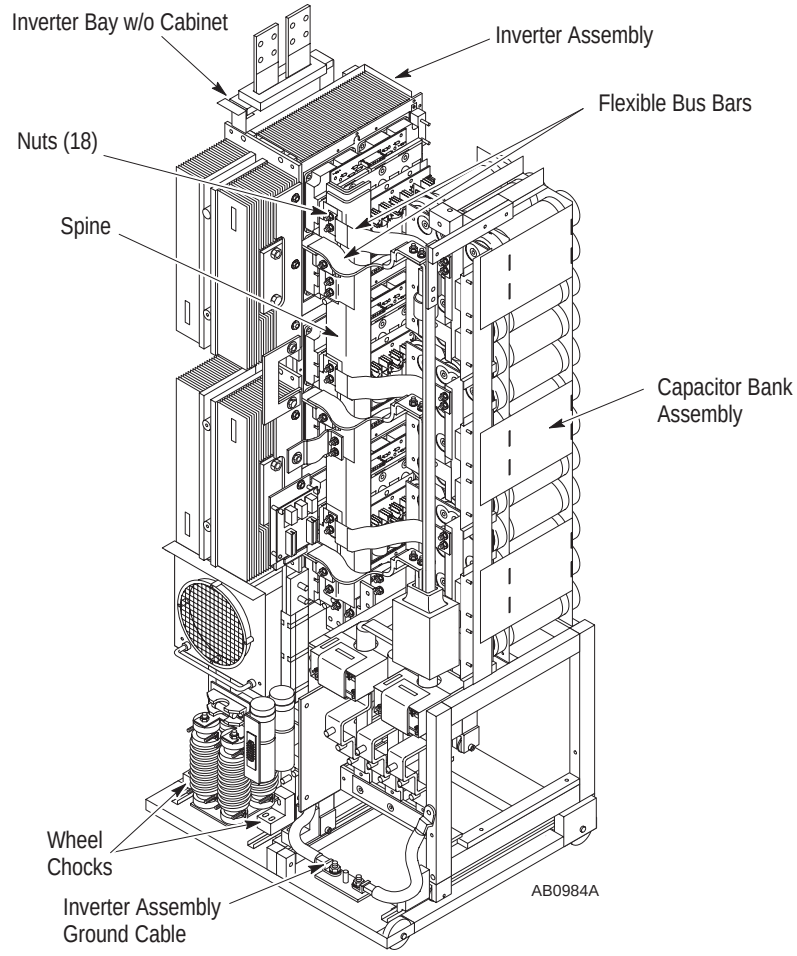
2. Remove the HV Guard that spans the bottom of the Inverter Bay (held in place with hook-and-loop strips).
3. Remove the incoming motor connections from the Motor Cable Terminals at the bottom right of the Inverter Bay. Refer to Figure 3.10.

Refer to Figure 3.10 and the following steps to remove the T bar from the front of the drive:

1. Loosen the lock-down bolt between the inverter and the left arm of the T bar.
2. Remove the T bar mounting bolt at the bottom of the T bar.
3. Remove the bolts fastening each arm of the T bar.
4. Release the Snapper Pin at the top of the T bar.

Refer to Figure 3.11 and the following steps to remove connections and the Spine:

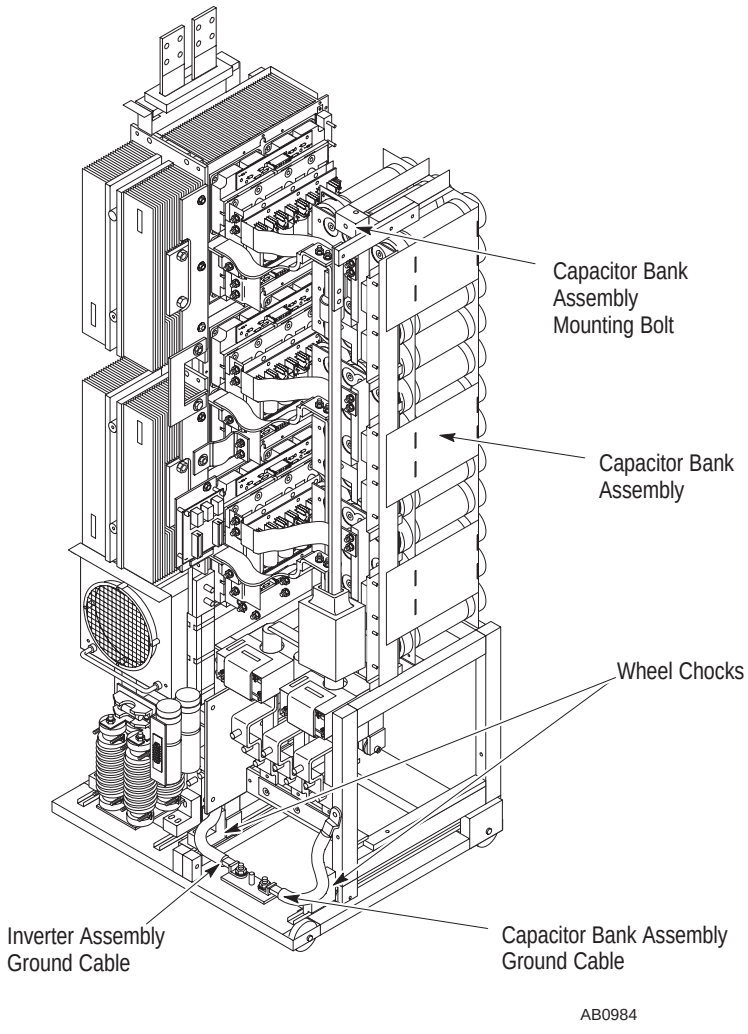
Figure 3.11
Disconnecting the Spine



1. Disconnect the Inverter Assembly ground cable from the ground plate at the bottom of the main frame.
2. Remove the 18 nuts fastening the flexible buses to the Spine.
3. Pull all the flexible leads to the right, out of the way.
4. Remove the Spine.
   - Push the Spine carefully to the right.
   - Lift it out of the drive without forcing it.
5. Disconnect any remaining wiring between the Inverter Assembly and the Capacitor Bank Assembly.

Referring to Figure 3.12, perform the following steps:

Figure 3.12
Disconnecting Ground Cables



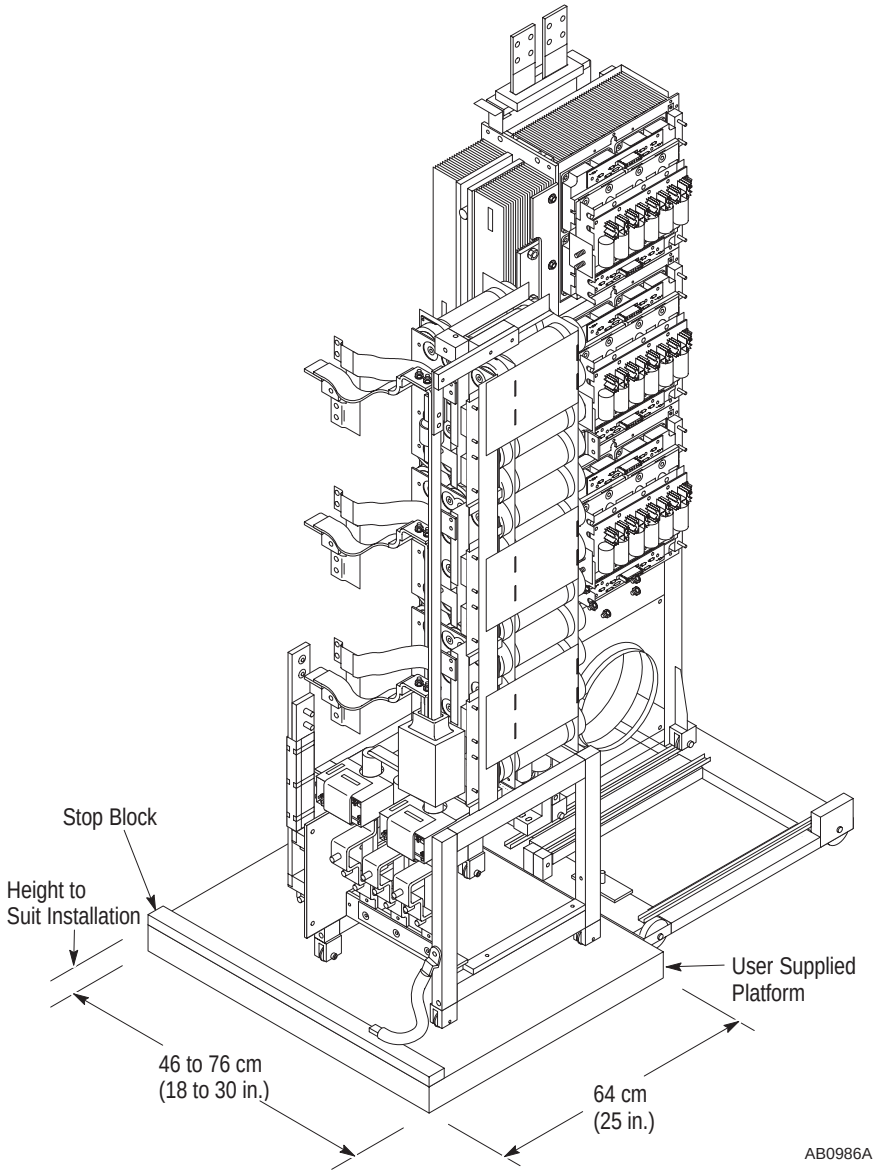
1. Disconnect the Capacitor Bank Assembly Ground Cable.
2. Disconnect any ground wires that obstruct removal of the assembly.

3. Remove the capacitor mounting bolt at the top center of the capacitor frame.
4. Remove the wheel chocks at the bottom of the Capacitor Bank Assembly.

ATTENTION: Hazard of tipping and severe injury exists. This process requires two people. The platform must be able to support 900 kg (2,000 lbs).

5. Using the Motor Buses as a handle, pull the assembly onto a user-supplied platform. Refer to Figure 3.13.

Figure 3.13
Capacitor Bank Assembly on Service Platform



Installation

Install the Capacitor Bank Assembly in reverse order of removal. Refer to Table 3.A – *Fastener Torque Specifications* in this chapter.

Important: Guide the unit into place so that it mates with the lock-down bolt at the top of the capacitor frame. Adjust the angle brackets at the ends of the T bar crossbar.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Pulling the Inverter Assembly

The Inverter Assembly must be pulled out to access internal components such as Power Modules.

The assembly has wheels that roll in tracks built into the base of the drive. Chocks bolted into the tracks prevent assembly movement. The drive itself also has wheels, built into the main framework of the drive.

Removal

ATTENTION: To remove the Inverter Assembly safely requires two persons. Attempting to remove either assembly by yourself may result in death or serious injury.

ATTENTION: The assembly weighs about 225 kg (500 pounds). Before you pull it from the drive, you must have a platform in place to hold the assembly. You cannot remove the assembly without a platform. The top of the platform must be even with the assembly's track. The platform must be strong enough to support the assembly and the personnel servicing the drive. Refer to Figure 3.16 in this chapter.

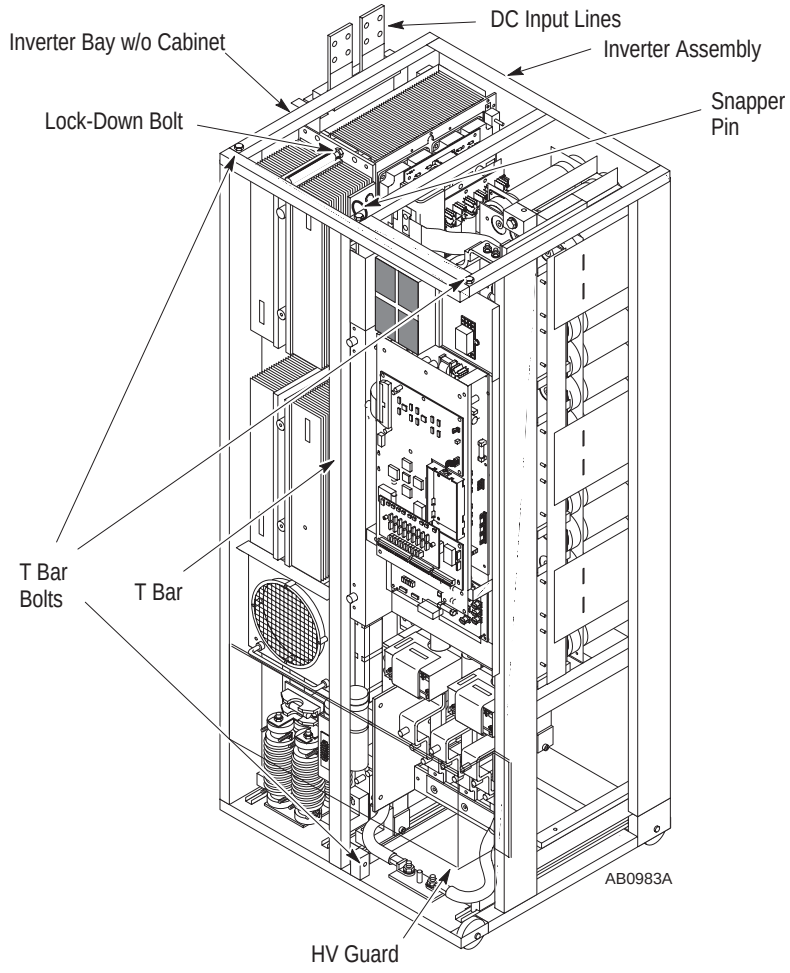
ATTENTION: Do not remove both the Inverter and the Capacitor Bank assemblies at the same time.

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify zero bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three bus fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to *Electrostatic Discharge Precautions* at the beginning of this chapter.

1. Perform the following procedures found earlier in this chapter:
   - *Opening the Drive Enclosure*
   - *Removing the Control Board Mounting Plate*
   - *Removing the Precharge Board Mounting Frame*
2. Remove the HV Guard that spans the bottom of the Inverter Bay (held in place with hook-and-loop strips).

Figure 3.14
Access to the Inverter Assembly



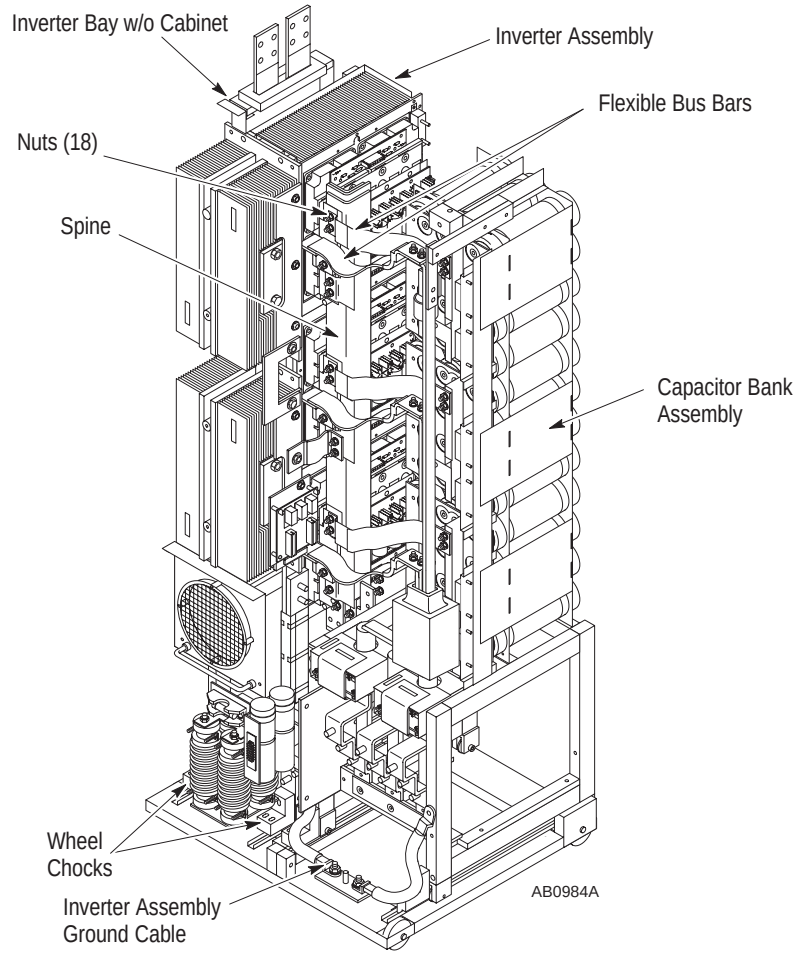
3. Referring to Figure 3.14, disconnect the buses from the DC input lines at the top left of the drive.

Refer to Figure 3.14 and the following steps, to remove the T bar from the front of the drive:

1. Loosen the lock-down bolt between the inverter and the left arm of the T bar.
2. Remove the T bar mounting bolt at the bottom of the T bar.
3. Remove the bolts fastening each arm of the T bar.
4. Release the Snapper Pin at the top of the T bar.

Refer to Figure 3.15 and the following steps, to remove connections and the Spine:

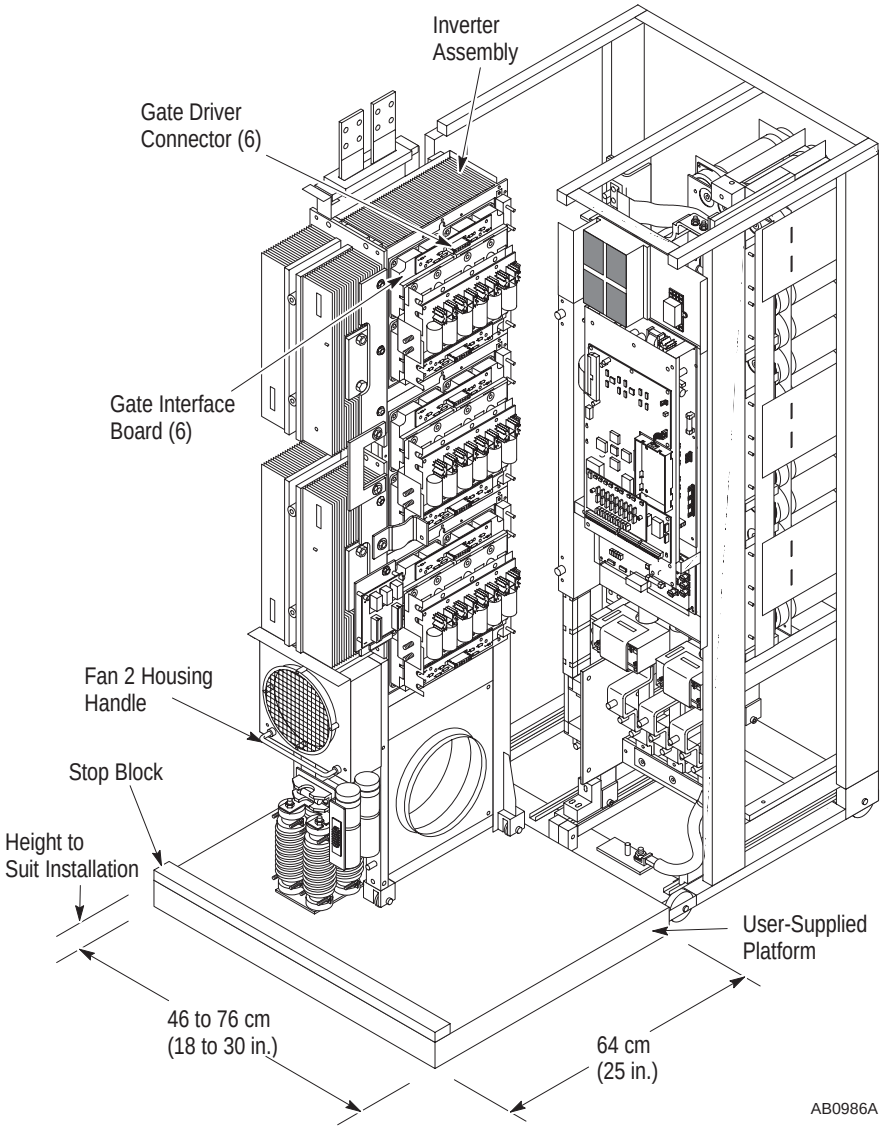
Figure 3.15
Disconnecting the Spine



1. Remove the 18 nuts fastening the flexible buses to the Spine.
2. Pull all the flexible leads to the right, out of the way.

3. Remove the Spine.
   - Push the Spine carefully to the right.
   - Lift it out of the drive without forcing it.
4. Disconnect any remaining wiring between the Inverter Assembly and the Capacitor Bank Assembly.
5. Disconnect the Inverter Assembly ground cable from the ground plate at the bottom of the Capacitor Bank Assembly.
6. Remove the wheel chocks at the bottom of the Inverter Assembly.

Figure 3.16
Service Platform



7. Remove the six Gate Driver connectors from the Gate Interface Boards on the Power Modules.

ATTENTION: Hazard of tipping and severe injury exists. This process requires two people. The platform must be able to support 900 kg (2,000 lbs).

8. Referring to Figure 3.16, pull the assembly onto a user-supplied platform. Pull using the handle attached to the Fan 2 housing.

Installation

Install the Inverter Assembly in reverse order of removal. Refer to Table 3.A – *Fastener Torque Specifications* in this chapter.

Important: When pushing the Inverter Assembly into the drive, you may need to have someone tip the unit slightly to the left or right to center it between the guides at the back of the Enclosure. Adjust the angle brackets at the ends of the T bar crossbar.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

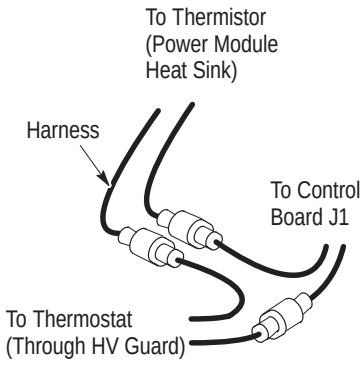
Removing Diode and SCR Heat Sinks

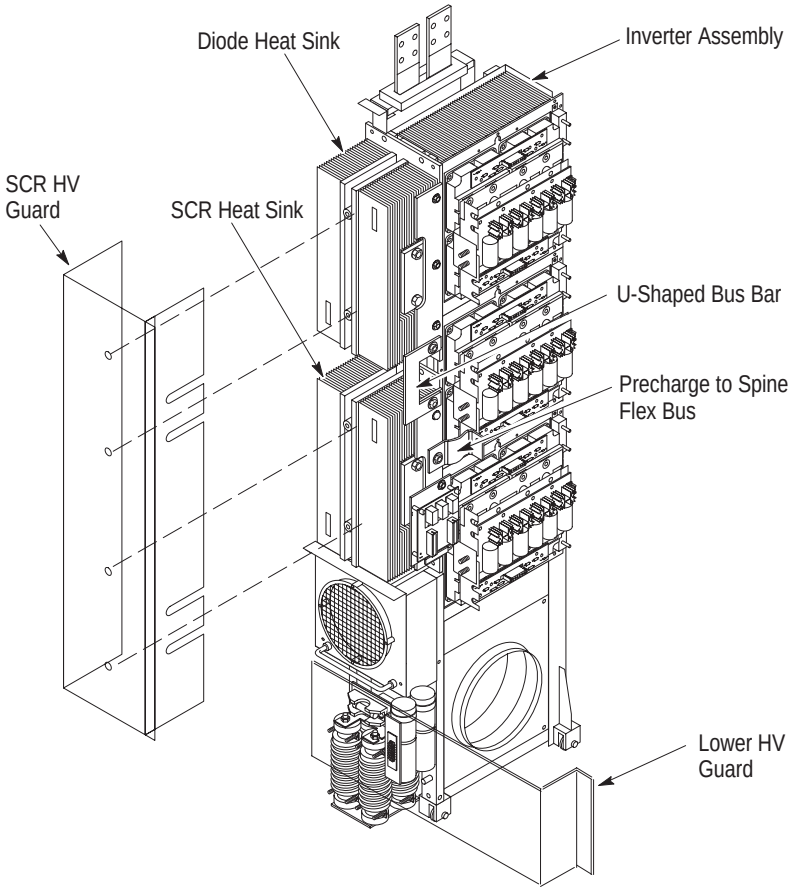
You may need to remove the Diode or SCR Heat Sink Assemblies if you have trouble replacing a Diode, SCR or Thermostat. Access to these components does not require the removal of the Inverter Assembly from the Inverter Bay. Figure 3.17 shows the Inverter Assembly removed for clarity.

Removal

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to *Electrostatic Discharge Precautions* at the beginning of this chapter.

Figure 3.17
Diode and SCR



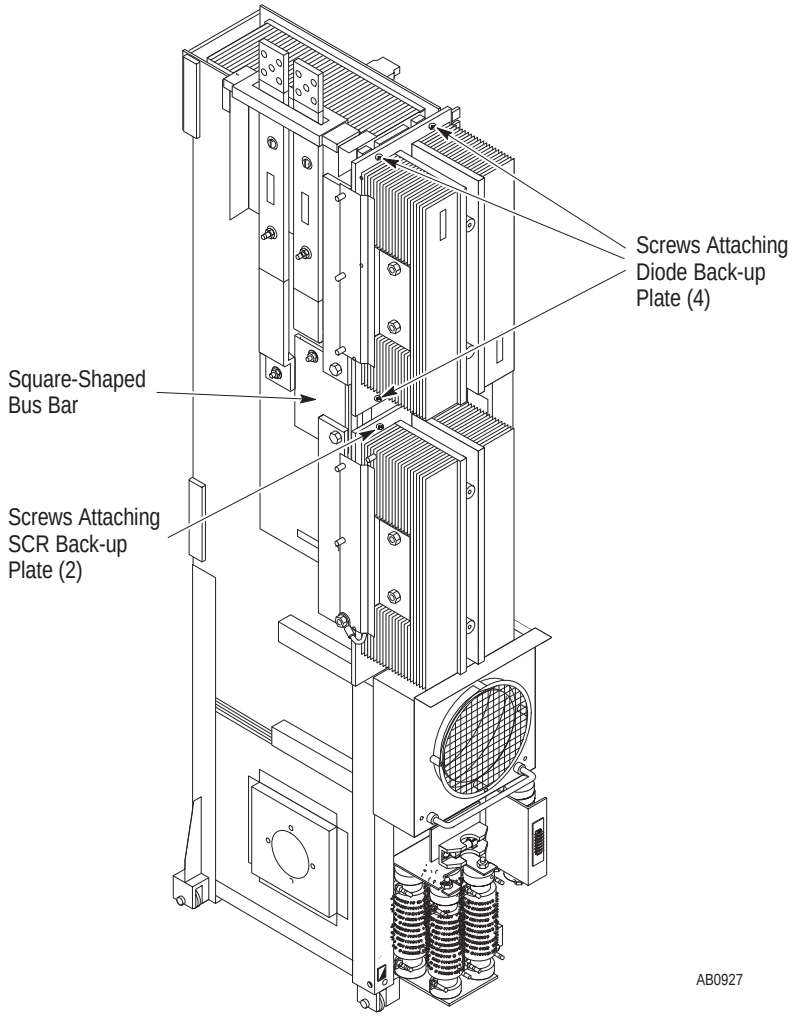


1. Perform the following procedures found earlier in this chapter:
   - *Opening the Drive Enclosure*
   - *Removing the Control Board Mounting Plate*

- *Removing the Precharge Board Mounting Frame*

2. Remove the Lower HV Guard spanning the bottom of the Inverter Bay (held in place with hook-and-loop strips).
3. A harness joins the Thermistor (Power Module) and Thermostat (SCR) to the Control Board. Disconnect the Thermostat leads from this harness.
4. Remove the screws on the SCR HV Guard.
5. Reach behind the SCR HV Guard and remove the leads from the SCR.
6. Pass the leads removed in the above steps through the hole in the HV Guard in order to free the guard.
7. Remove the square shaped bus bar on the left side of the Inverter Assembly, refer to Figure 3.18.

Figure 3.18
Left Side View



8. Remove the screws that attach the Back-up Plate to the steel frame, four screws for the Diode heat sink, two screws for the SCR heat sink (Figure 3.18).
9. Remove the screws that hold the appropriate heat sink to the Back-up Plate.
10. Remove the heat sink.

Installation

Refer to Table 3.A – *Fastener Torque Specifications* in this chapter.

1. Attach the heat sink to the Back-up Plate.
2. Attach the Back-up Plate to the Inverter Assembly.
3. Install the square bus bar.
4. Route leads from thermostat through the hole in the HV Guard (going out of enclosure).
5. Route leads for the SCR through the hole in the HV Guard (going into the enclosure).
6. Re-connect the gate and cathode leads to the SCR.
7. Reinstall the four screws that hold the HV Guard in place.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Component Test Procedures

Chapter Objectives

The following tests help you troubleshoot the drive.

Component Test Overview

The component test procedures in this chapter assume that the drive enclosure is open. For more information on opening the drive enclosure, refer to Chapter 3, *Access Procedures*.

ATTENTION: Some printed circuit boards and drive components may contain hazardous voltage levels. Remove and lock out power before you disconnect or reconnect wires, and before you remove or replace fuses and circuit boards. Verify bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three bus fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Servicing energized industrial control equipment can be hazardous. Electrical shock, burns, or unintentional actuation of controlled industrial equipment may cause death or serious injury. Follow the safety-related practices of NFPA 70E, *Electrical Safety for Employee Workplaces*, when working on or near energized equipment. Do not work alone on energized equipment.

Electrostatic Discharge Precautions

ATTENTION: This assembly contains parts and sub-assemblies that are sensitive to electrostatic discharge. Static control precautions are required when servicing this assembly. Component damage may result if you ignore electrostatic discharge control procedures. If you are not familiar with static control procedures, reference Rockwell Automation Publication 8000-4.5.2, *Guarding Against Electrostatic Discharge*, or any other applicable ESD protection handbook.

Electrostatic discharge generated by static electricity can damage the complementary metallic oxide semiconductor devices on various drive boards. It is recommended that you perform these procedures to guard against this type of damage when circuit boards are removed or installed:

- Wear a wrist-type grounding strap that is grounded to the chassis.
- Attach the wrist strap before removing the new circuit board from the conductive packet.
- Remove boards from the drive and immediately insert them into their conductive packets.

Tools

For a list of tools required, tightening sequences, and fastener torque specifications, refer to *Fastener Torque Specifications* in Chapter 3, *Access Procedures*.

Test 1 – Testing the Gate Driver Board

The Gate Driver Board is located behind the Control Board, on the Precharge Board Mounting Frame. If power modules were replaced, replace the Gate Driver Board. If a new Gate Driver Board is not available, test the old board using the following procedure.

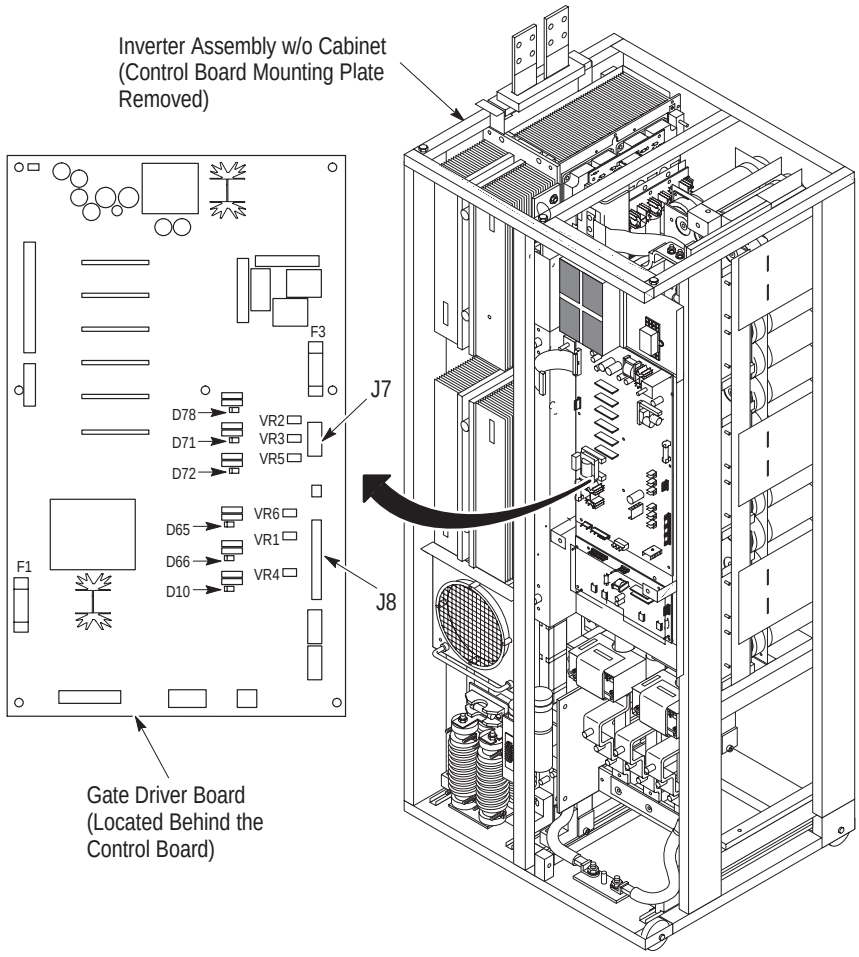
ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to *Electrostatic Discharge Precautions* in Chapter 3, *Access Procedures*.

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify zero bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three bus fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Perform the following procedures in Chapter 3, *Access Procedures*.
   - *Opening the Drive Enclosure*
   - *Removing the Control Board Mounting Plate*
2. Test Gate Driver Board fuses F1 and F3 for an open condition. Replace the Gate Driver Board if either fuse shows an open condition.
3. Set your meter to test diodes.
4. Test VR1 to VR6. Table 4.A shows meter connections at J7 and J8, and nominal meter readings for those connections. Refer to Figure 4.1 for component locations.
5. Replace the Gate Driver Board if your readings do not match the table readings. Refer to *Replacing the Gate Driver Board* in Chapter 5, *Part Replacement Procedures*.

Figure 4.1
Gate Driver Board Test



6. Check all six reverse-bias Zener diodes: D10, D66, D65, D72, D71, and D78. Table 4.B shows meter connections at the components and ideal meter readings for those connections. Refer to Figure 4.1 for component locations.

7. Replace the Gate Driver Board if your readings do not match the table, or if any diode is shorted or open in both directions. Refer to *Replacing the Gate Driver Board* in Chapter 5, *Part Replacement Procedures*.

Table 4.A
Diode Test

Component	Meter (+) Lead	Meter (–) Lead	Nominal Meter Reading*
VR1	J7-1 J7-2	J7-2 J7-1	1.2 +/–5% 0.7 +/–5%
VR2	J7-3 J7-4	J7-4 J7-3	1.2 +/–5% 0.7 +/–5%
VR3	J7-5 J7-6	J7-6 J7-5	1.2 +/–5% 0.7 +/–5%
VR4	J8-1 J8-2	J8-2 J8-1	1.2 +/–5% 0.7 +/–5%
VR5	J8-6 J8-7	J8-7 J8-6	1.2 +/–5% 0.7 +/–5%
VR6	J8-11 J8-12	J8-12 J8-11	1.2 +/–5% 0.7 +/–5%

Note: Typical malfunction is shorted in both directions.

* Meter Used: Fluke® Model 87, set to "Diode" range.

Table 4.B
Zener Diode Test

Component	Meter (+) Lead	Meter (–) Lead	Nominal Meter Reading
D78	Left Right	Right Left	less than 1 open
D71	Left Right	Right Left	less than 1 open
D72	Left Right	Right Left	less than 1 open
D65	Left Right	Right Left	less than 1 open
D66	Left Right	Right Left	less than 1 open
D10	Left Right	Right Left	less than 1 open

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Test 2 – Testing the Power Modules

The Power Modules are located on three heat sinks in the Inverter Housing Assembly. If Power Modules have been replaced, you must check the corresponding Power Module Snubber Board and Snubber Resistor in addition to replacing the Gate Driver Board.

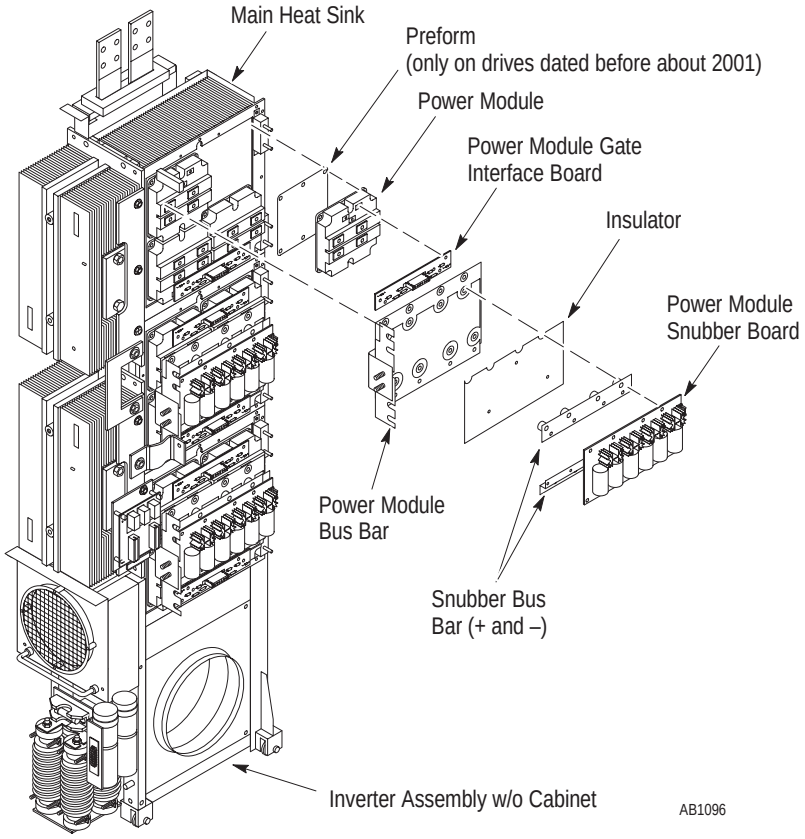
ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to *Electrostatic Discharge Precautions* in Chapter 3, *Access Procedures*.

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify zero bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three bus fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Perform the following procedures in Chapter 3, *Access Procedures*.
   - *Opening the Drive Enclosure*
   - *Removing the Control Board Mounting Plate*
   - R*emoving the Precharge Board Mounting Frame*
   - *Pulling the Inverter Assembly*
2. Remove the Snubber Resistor connections from the Snubber Board, J1 and J2.
3. Remove the screws fastening the Power Module Snubber Board to the Snubber Bus Bars.

Figure 4.2
Power Modules



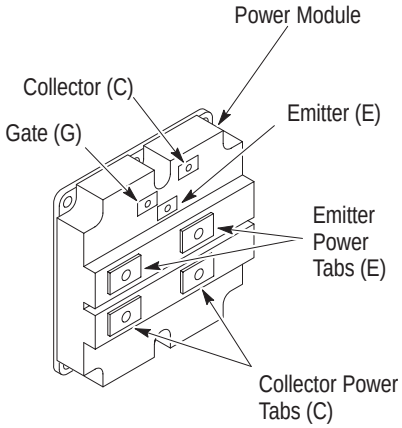
Transistor Test

1. Remove the screws fastening the positive and negative Snubber Bus Bars to the Power Module Bus Bar.
2. Remove the screws fastening the Power Module Bus Bar to the Power Modules.
3. Carefully remove the bus bar. Do not damage the Insulator.
4. Set your meter to test diodes.
5. Test the Power Modules. Table 4.C shows meter connections and ideal meter readings for those connections. Refer to Figure 4.3 for meter connection locations.
6. Replace a Power Module if meter readings are not as shown. Refer to *Replacing a Power Module* in Chapter 5, *Part Replacement Procedures*.

Table 4.C
Power Module Transistor Readings

Meter (+) Lead	Meter (–) Lead	Nominal Meter Reading
E	C	0.218–0.418
E	G	Infinite
C	E	Infinite
C	G	Infinite
G	E	Infinite
G	C	Infinite

Figure 4.3
Power Module Transistor Test



7. For any Power Module that has failed, continue with the following tests for the Snubber Resistor and Snubber Board associated with the failed Power Module.

8. If any Power Module has failed, perform the following:

- Replace the Gate Driver Board, or at least perform *Test 1 – Testing the Gate Driver Board*.
- Replace the Power Module Snubber Board.

Snubber Resister Test

1. Set your meter to measure resistance.

2. Test the Power Module Snubber Resistors. The reading should be 16 ohms each.

Two 16-ohm resistors are wired in parallel, in pairs. If measured with the wiring in place, the effective resistance is 8 ohms total.

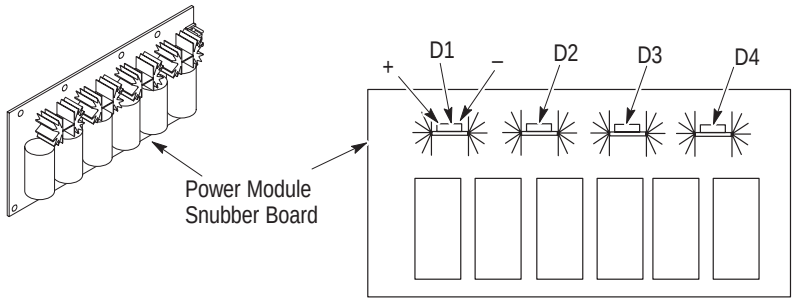
3. If open, replace the snubber resistor. Refer to *Replacing a Power Module Snubber Resistor* in Chapter 5, *Part Replacement Procedures*.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Snubber Board Test

1. Set your meter to test diodes.
2. Test D1 to D4. Table 4.D shows meter connections, and nominal meter readings for those connections. Refer to Figure 4.4 for component locations.

Figure 4.4
Power Module Snubber Board



3. Replace the Snubber Board if your readings do not match the table readings. Refer to *Replacing the Power Module Snubber Board* in Chapter 5, *Part Replacement Procedures*.

Table 4.D
Power Module Snubber Board Test

Component	Meter (+) Lead	Meter (–) Lead	Nominal Meter Reading*
D1 – D4	Left Right	Right Left	Less than 1 Open

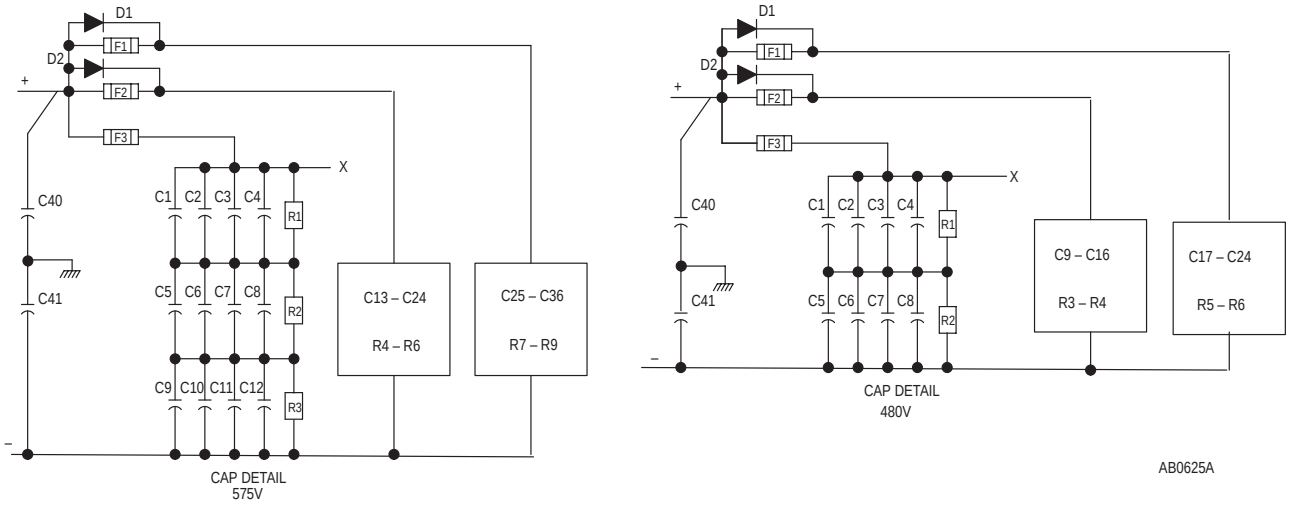
Note: Typical malfunction is shorted in both directions.

* Meter Used: Fluke® Model 87, set to "Diode" range.

Test 3 – Testing the Volt-Sharing Resistors and Dual Diodes

The Volt-Sharing Resistors and Dual Diodes are mounted on the Balancer Plate Assembly on the right wall of the Capacitor Bank Assembly. The wiring of this assembly is illustrated in Figure 4.5.

Figure 4.5
Volt-Sharing Resistor Connections to Bus Capacitors



ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to *Electrostatic Discharge Precautions* in Chapter 3, *Access Procedures*.

1. Referring to *Opening the Drive Enclosure* in Chapter 3, *Access Procedures*, remove power and check for zero voltage in the drive.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

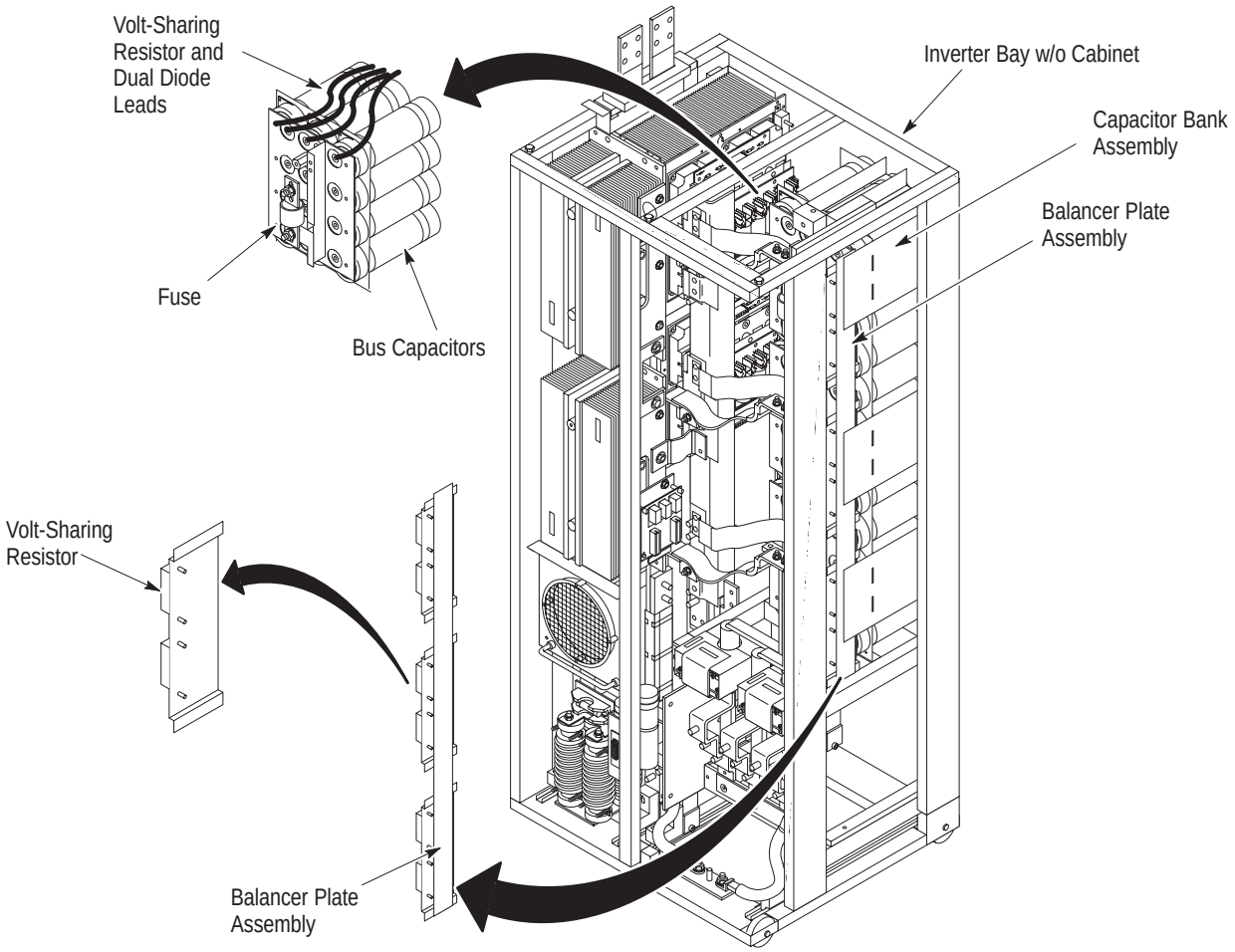
2. Remove the black leads on the top row of capacitors in each set of capacitors.
3. Remove Fuses: F1, F2, and F3.

Volt-Sharing Resistor Test

1. Set your meter to test resistance (range 20k Ohm).

2. Connect a meter lead to the leads from each end of a Volt-Sharing Resistor. Refer to Figure 4.6. Expect a meter reading of 4.3k Ohms +/– 10%.
3. Repeat the above test for each Volt-Sharing Resistor.
4. If any resistors are out of tolerance, refer to *Removing Volt-Sharing Resistors and Dual Diodes* in Chapter 5, *Part Replacement Procedures*.

Figure 4.6
Balancer Plate Assembly



Dual Diode Test

1. Set your meter to test diodes.
2. Test D1 and D2. Table 4.E shows meter connections, and nominal meter readings for those connections. Refer to Figure 4.4 for component locations.

3. If either diode is out of tolerance, refer to *Replacing Volt-Sharing Resistors and Dual Diodes* in Chapter 5, *Part Replacement Procedures*.

Table 4.E
Dual Diode Test

Component	Meter (+) Lead	Meter (–) Lead	Nominal Meter Reading*
D1	Top Bottom	Bottom Top	Less than 1 Open
D2	Top Bottom	Bottom Top	Less than 1 Open

Note: Typical malfunction is shorted in both directions.

* Meter Used: Fluke® Model 87, set to "Diode" range.

Important: There is no diode on F3.

Capacitor Test

The only practical test for these capacitors is to look for signs of damage: swelling, leaking, or burn marks. To replace the Bus Capacitors, refer to *Replacing Bus Capacitors* in Chapter 5, *Part Replacement Procedures*.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Test 4 – Testing the Diode and SCR

The Diode and SCR Heat Sink Assemblies are mounted on the front of the Inverter Assembly. The Diode and SCR Heat Sinks must be electrically isolated from each other and from the rest of the power circuit, to properly test the individual components.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to *Electrostatic Discharge Precautions* in Chapter 3, *Access Procedures*.

1. Perform the following procedures in Chapter 3, *Access Procedures*.
   - *Opening the Drive Enclosure*
   - *Removing the Control Board Mounting Plate*

ATTENTION: Servicing energized industrial control equipment can be hazardous. Electrical shock, burns, or unintentional actuation of controlled industrial equipment may cause death or serious injury. Follow the safety-related practices of NFPA 70E, *Electrical Safety for Employee Workplaces*, when working on or near energized equipment. Do not work alone on energized equipment.

2. To isolate the Diode from the rest of the power circuit, remove the U-shaped bus bar that connects the Diode heat sink to the SCR heat sink, refer to Figure 4.7.
3. To isolate the SCR from the Capacitor Bank, remove the precharge to spine flex bus, refer to Figure 4.7.

ATTENTION: When testing the Diode or SCR it is important that the Diode and SCR clamps be at their normal torques.

The Diode and SCR checks in the following steps have a range of acceptable readings. Readings vary depending on the type of meter used – digital meters with a diode scale, or analog meters without a diode scale. In general a Diode should never be shorted from Cathode (1) to Anode (2). An SCR should never be shorted from Cathode (4) to Anode (3). An SCR should read a relatively low resistance from the Cathode (4) to the Gate (G). An SCR should never read open resistance from the Cathode (4) to the Gate (G).

Figure 4.7
Diode and SCR Location

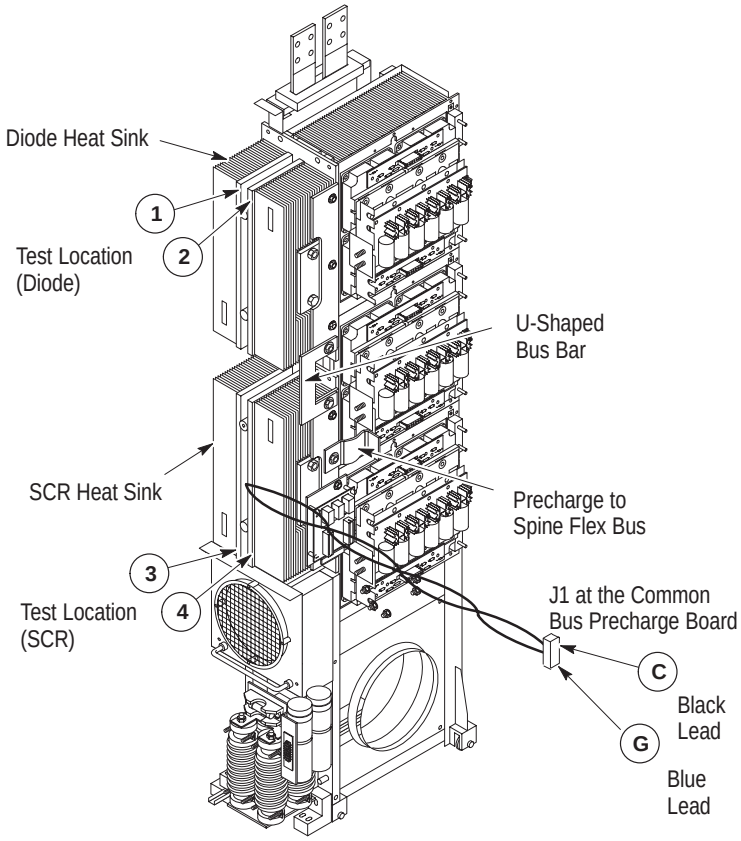
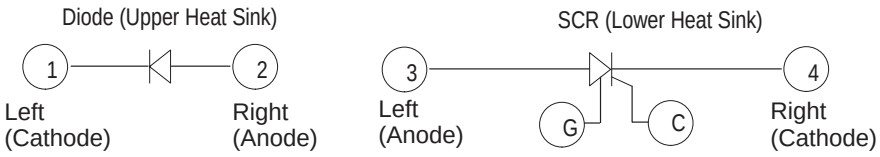


Figure 4.8
Diode and SCR Circuit



ATTENTION: Resistance or voltage checks made on the Diode or SCR heat sinks must be made to the heat sink aluminum base plate, not the aluminum fins, refer to Figure 4.7. The heat sinks have an epoxy bonded fin, and many of the fins are NOT electrically connected to the aluminum base plate.

4. Diode check: Connect the meter leads at the points identified in Figure 4.7 and check for the values indicated in Table 4.F.

Table 4.F
Diode Readings

Meter Leads		Ohms Reading	Diode Scale Volts
+	–		
1	2	1 to 3 M Ohm (not shorted)	Open (not shorted)
2	1	0 to 0.4 M Ohm (not shorted)	0.3 to 0.4 V (not shorted)

5. SCR check: Connect the meter leads at the points identified in Figure 4.7 and check for the values indicated in Table 4.G.

Table 4.G
SCR Readings

Meter Leads		Ohms Reading	Diode Scale Volts
+	–		
3	4	1 to 3 M Ohm (not shorted)	Open (not shorted)
4	3	1 to 3 M Ohm (not shorted)	Open (not shorted)
G	4	5 to 20 Ohm (not open)	Less than 1 (not open)
4	G	5 to 20 Ohm (not open)	Less than 1 (not open)

6. If SCR or Diode test fail, refer to *Replacing a Diode, SCR or Thermostat* in Chapter 5, *Part Replacement Procedures*.

7. If SCR and Diode tests pass, re-install the following bus bars. Refer to Table 3.A – *Fastener Torque Specifications* in Chapter 3, *Access Procedures*.

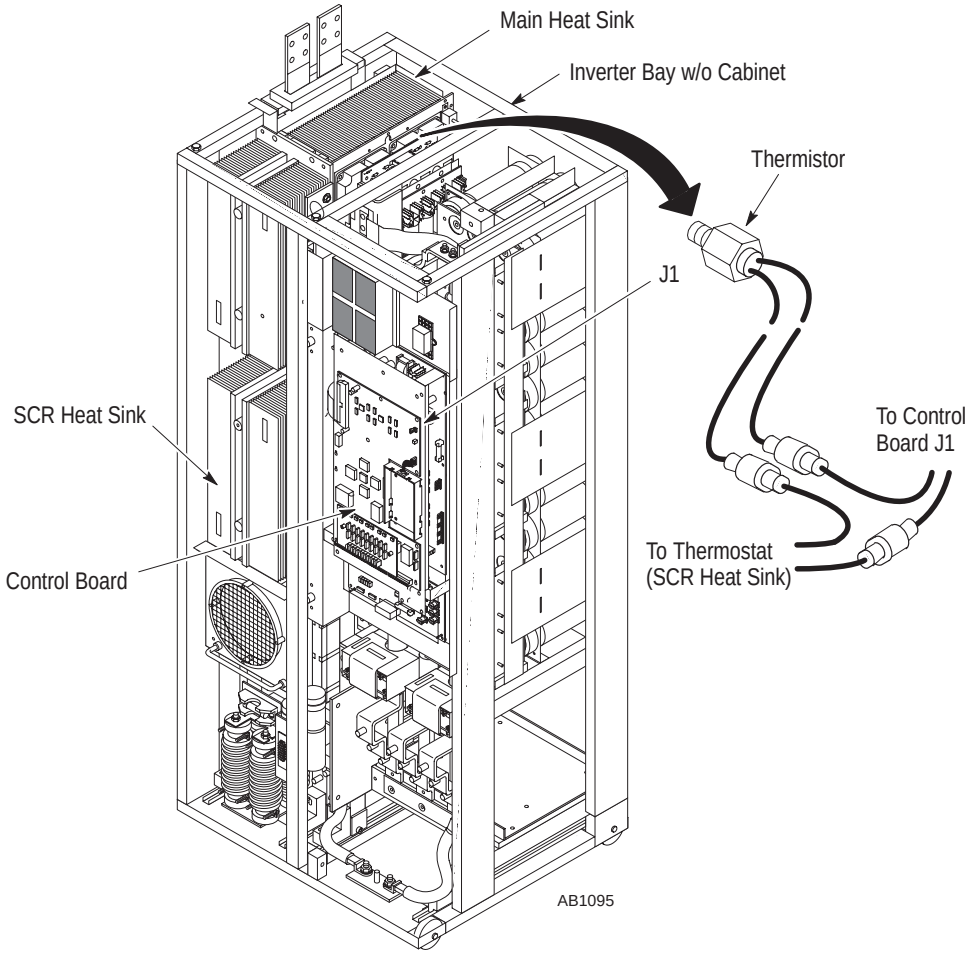
- U-shaped bus bar
- Precharge to spine flex bus

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Test 5 – Testing the Thermistor and Thermostat

The Thermistor and Thermostat are wired in series on a harness connected to the Control Board.

Figure 4.9
Thermistor



ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to *Electrostatic Discharge Precautions* in Chapter 3, *Access Procedures*.

1. Referring to *Opening the Drive Enclosure* in Chapter 3, *Access Procedures*, remove power and check for zero voltage in the drive.

ATTENTION: Servicing energized industrial control equipment can be hazardous. Electrical shock, burns, or unintentional actuation of controlled industrial equipment may cause death or serious injury. Follow the safety-related practices of NFPA 70E, *Electrical Safety for Employee Workplaces*, when working on or near energized equipment. Do not work alone on energized equipment.

2. At the Control Board, remove the connector at J1.
3. Set your meter to test resistance (range 200k Ohm).
4. Connect the meter leads to the harness connector.
5. If the Main Heat Sink and SCR Heat Sink are at room temperature, expect a reading of about 100k Ohms – less if the Main Heat Sink is very warm.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

6. If the test indicates a short or an open, break the harness at the in-line connectors and test the Thermistor and Thermostat individually.
   - Expect the Thermistor to read about 100k Ohms
   - Expect the Thermostat to show a short unless the SCR Heat Sink is very hot. If the Thermostat shows an open circuit, wait until the SCR Heat Sink is cool and retest.
7. Refer to *Replacing a Thermistor* in Chapter 5, *Part Replacement Procedures*, to replace a failed (open or shorted) Thermistor.
8. Refer to *Replacing a Diode, SCR or Thermostat* in Chapter 5, *Part Replacement Procedures*, to replace a failed (open) Thermostat.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

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Part Replacement Procedures

Chapter Objectives

This chapter describes procedures required to replace drive components. This chapter references Chapter 3, *Access Procedures* for basic drive component access.

Part Replacement Overview

The part replacement procedures in this chapter assume that the drive enclosure is open. For more information on opening the drive enclosure, refer to Chapter 3, *Access Procedures.*

Safety Precautions

ATTENTION: Some printed circuit boards and drive components may contain hazardous voltage levels. Remove power before you disconnect or reconnect wires, and before you remove or replace fuses and circuit boards. Verify bus voltage by measuring the voltage between between the Negative Capacitor Bus and both ends of all three bus fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

Electrostatic Discharge Precautions

ATTENTION: This assembly contains parts and sub-assemblies that are sensitive to electrostatic discharge. Static control precautions are required when servicing this assembly. Component damage may result if you ignore electrostatic discharge control procedures. If you are not familiar with static control procedures, reference Rockwell Automation Publication 8000-4.5.2, *Guarding Against Electrostatic Discharge*, or any other applicable ESD protection handbook.

Electrostatic discharge generated by static electricity can damage the complementary metallic oxide semiconductor devices on various drive boards. It is recommended that you perform these procedures to guard against this type of damage when circuit boards are removed or installed:

- Wear a wrist-type grounding strap that is grounded to the chassis.
- Attach the wrist strap before removing the new circuit board from the conductive packet.
- Remove boards from the drive and immediately insert them into their conductive packets.

For a list of tools required, tightening sequences, and fastener torque specifications, refer to *Fastener Torque Specifications* in Chapter 3, *Access Procedures*.

Detailed Product Identification

Allen-Bradley Adjustable Frequency AC Drives are modular by design to enhance troubleshooting and spare parts replacement, thereby helping reduce production down-time.

Figure 5.2 and 5.1 identify the main components of a typical drive. Component designs vary slightly among the different drive ratings. Also, the Converter Bay is configured to each order and can vary considerably. For that reason, Converter Bay illustrations show less detail than the Inverter Bay illustrations.

Figure 5.1
Converter Bay Parts (Typical)

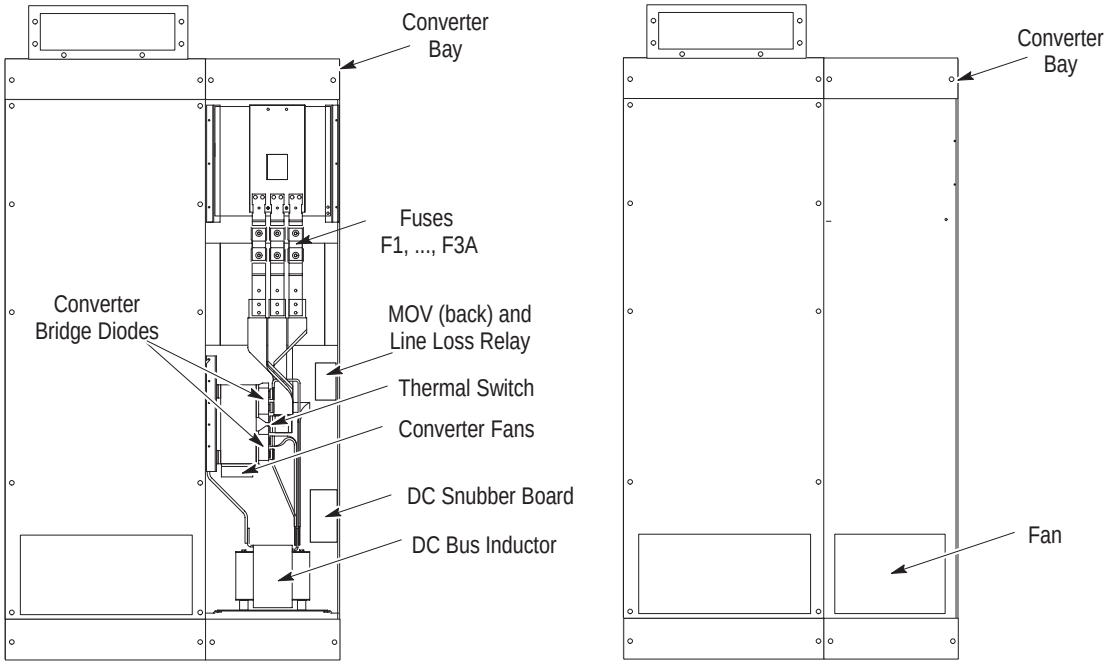
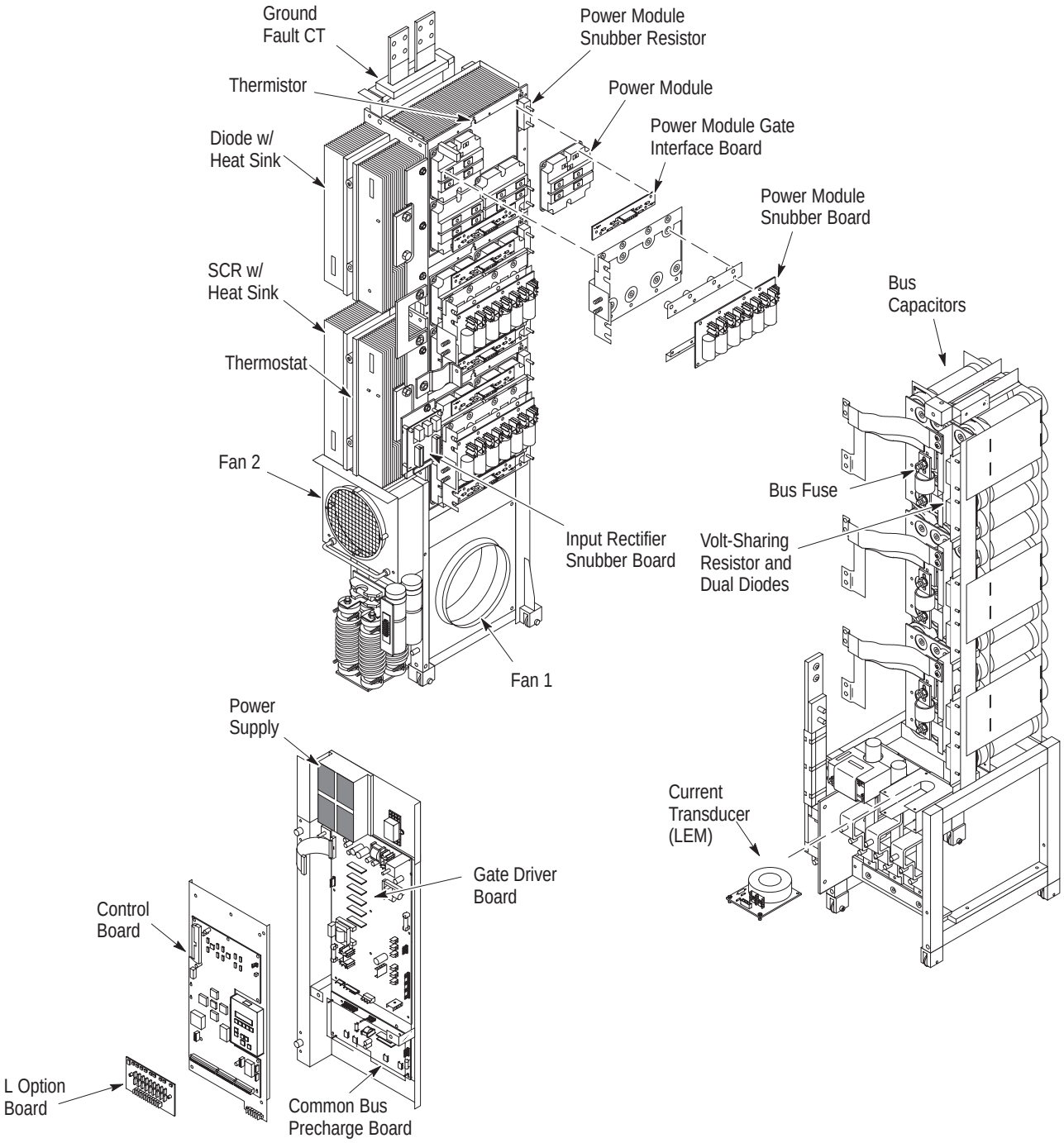
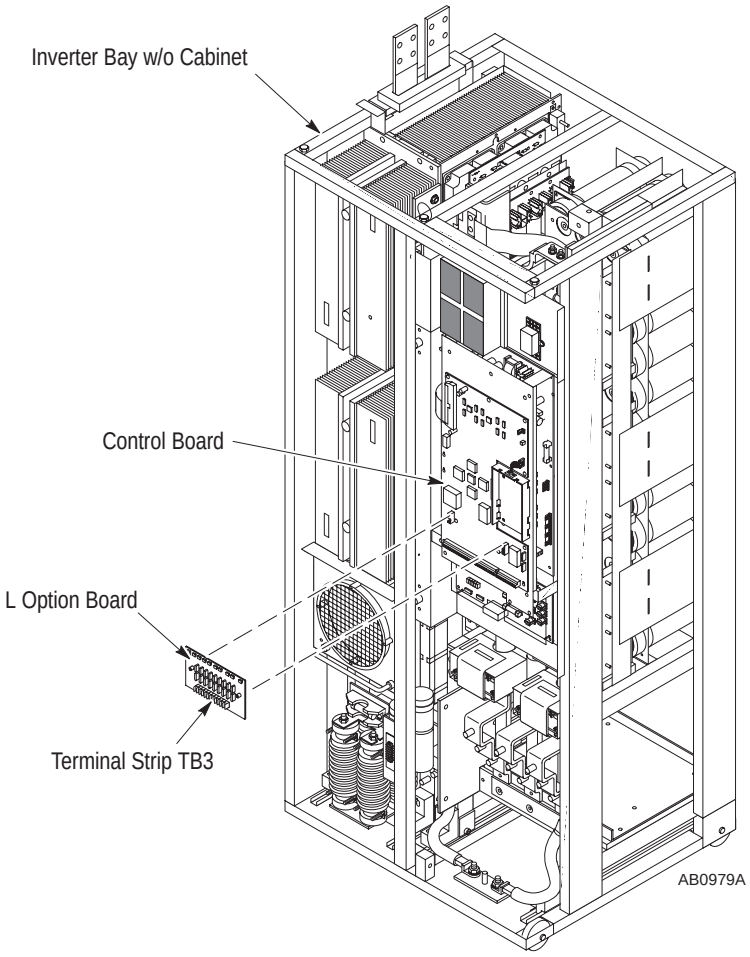


Figure 5.2
Exploded View of Inverter Bay



Replacing the L Option Board

Figure 5.3
L Option Board



Removal

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

1. Remove power and check for zero voltage in the drive. Refer to *Opening the Drive Enclosure* in Chapter 3, *Access Procedures*.

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify zero bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three bus fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

2. Remove all wires from Terminal Strip TB3.
3. Loosen the two captive screws fastening the L Option Board to the Control Board.
4. Grip the right and left sides of the L Option Board and pull the board straight out from the Control Board.

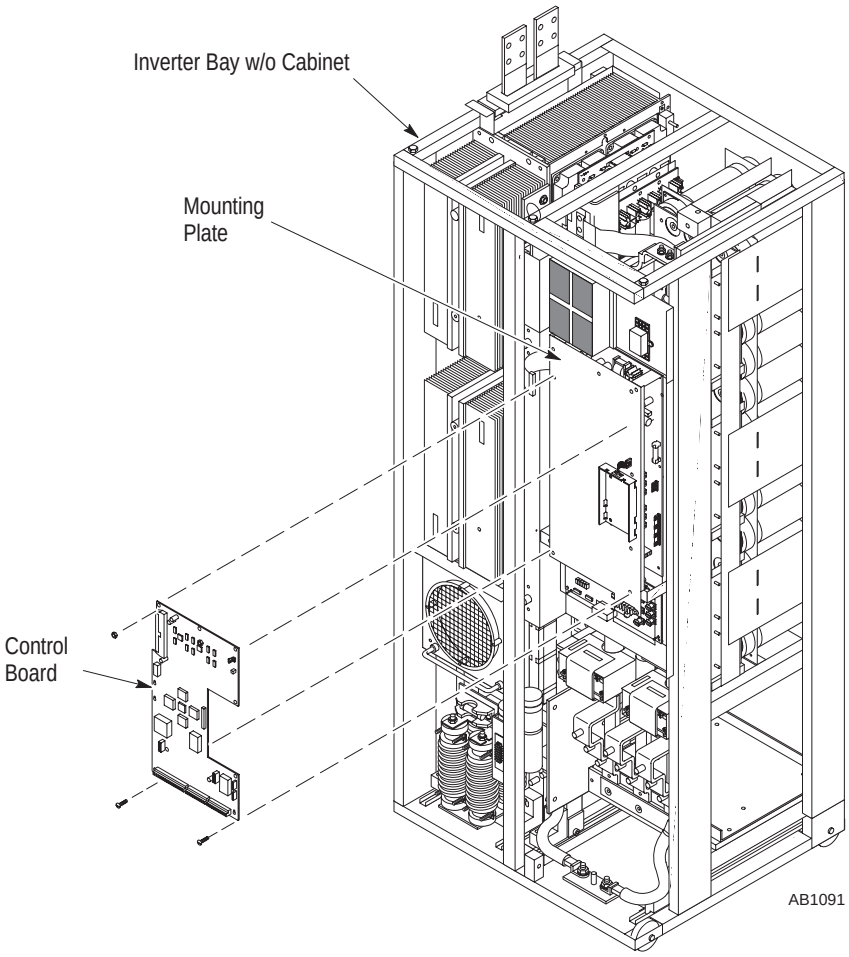
Installation

Install the L Option Board in reverse order of removal.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Replacing the Control Board

Figure 5.4
Control Board



Removal

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to *Electrostatic Discharge Precautions* at the beginning of this chapter.

1. Remove power and check for zero voltage in the drive. Refer to *Opening the Drive Enclosure* in Chapter 3, *Access Procedures*.

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify zero bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three bus fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

2. Remove all wires from Terminal Strip TB3 if an L Option Board is used.
3. Disconnect the following from the Control Board:
   - All connectors
   - Ground wire at stake-on connector
   - All wires from the terminals on TB10 and TB11
4. Remove the screws fastening the Control Board to the Mounting Plate.
5. Slide the Control Board toward the top of the drive to release it from the slide-mount stand-offs.
6. Store the Control Board in an anti-static bag.

Installation

Install the Control Board in reverse order of removal.

Important: When installing a new Control Board, move the Language Module and L Option board (if present) from the old board to the new board.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Replacing the Gate Driver Board

Removal

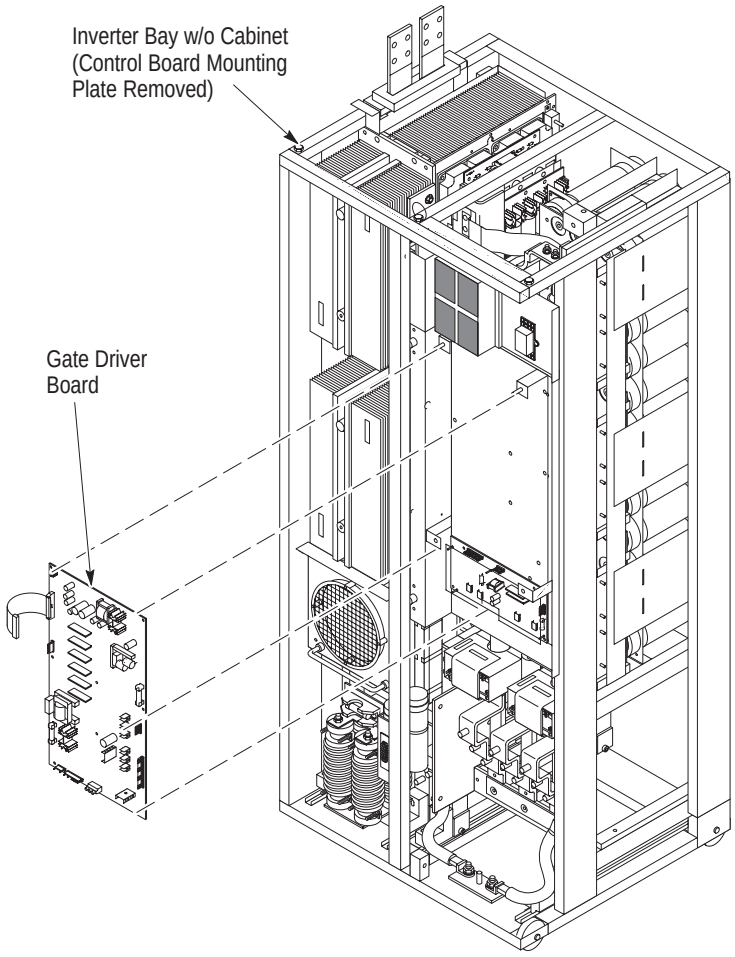
ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to *Electrostatic Discharge Precautions* in Chapter 3, *Access Procedures*.

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify zero bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three bus fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Perform the following procedures in Chapter 3, *Access Procedures*.
   - *Opening the Drive Enclosure*
   - *Removing the Control Board Mounting Plate*
2. Disconnect the following from the Gate Driver Board:
   - All connectors
   - Wires at TB7
3. Turn the eight fasteners, 1/4 turn counterclockwise to remove the board.
4. Store the Gate Driver Board in an anti-static bag.

Figure 5.5
Gate Driver Board



Installation

Install the Gate Driver Board in reverse order of removal. Refer to Table 3.A – *Fastener Torque Specifications*.

ATTENTION: When installing the wire harness connecting Gate Driver Board connector J9 to Common Bus Precharge Board connector J3, align the wires on the harness terminals with the pins on the board connectors. Incorrect harness connection may result in faulty drive operation and may damage the equipment.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Replacing the Common Bus Precharge Board

Removal

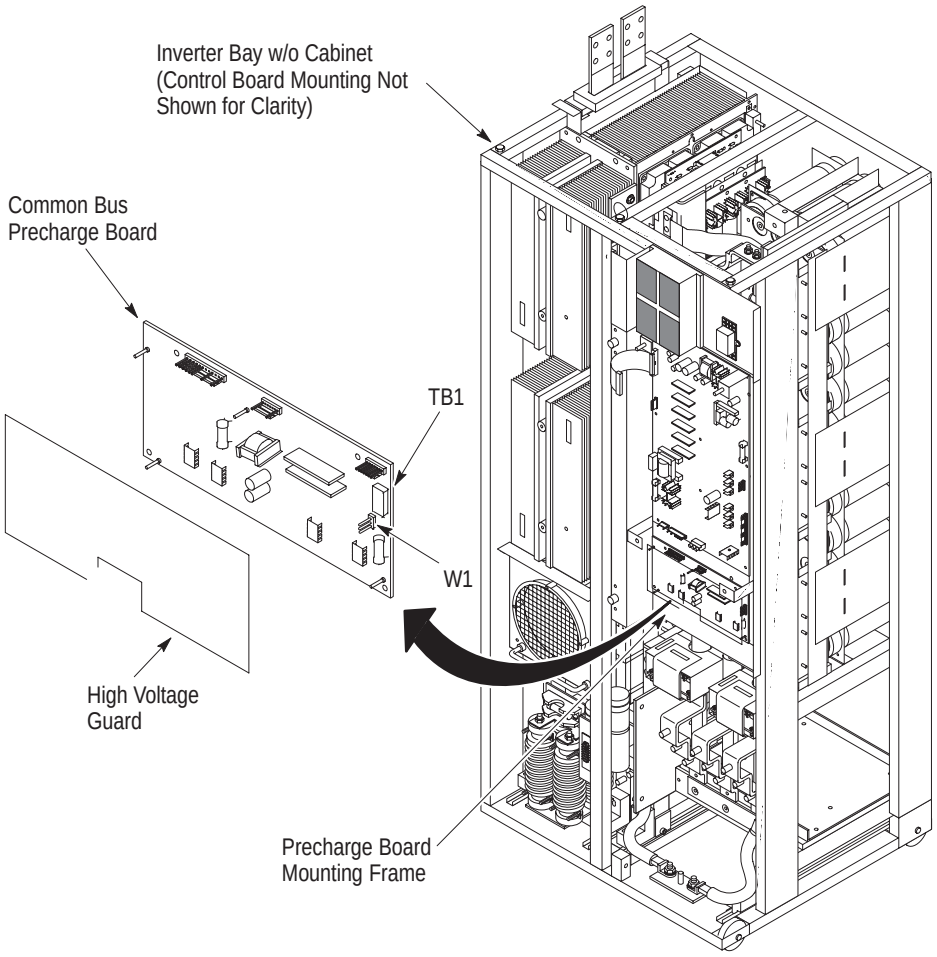
ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to *Electrostatic Discharge Precautions* in Chapter 3, *Access Procedures*.

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify zero bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three bus fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Perform the following procedures in Chapter 3, *Access Procedures*.
   - *Opening the Drive Enclosure*
   - *Removing the Control Board Mounting Plate*
2. Disconnect the following from the Common Bus Precharge Board:
   - All connectors
   - Wires at TB1
3. Pinch the four stand-offs to remove the Common Bus Precharge Board High Voltage Guard.
4. Turn the four fasteners, 1/4 turn counterclockwise to remove the board.
5. Store the Common Bus Precharge Board in an anti-static bag.

Figure 5.6
Common Bus Precharge Board



Installation

ATTENTION: The wrong jumper setting at W1 will either damage the Common Bus Precharge Board, or prevent proper precharge operation.

1. The leads attached to TB1 are either at 24VDC or 120VAC. Set the jumper position on W1 for the correct TB1 voltage. Refer to Table 4.G.

Table 5.A
W1 Jumper Settings

W1 Jumper Position	Voltage Between Leads Attached at TB1
1 to 2	24VDC
2 to 3	120VAC

2. Install the Common Bus Precharge Board in reverse order of removal.

ATTENTION: When installing the wire harness connecting Gate Driver Board connector J9 to Common Bus Precharge Board connector J3, align the wires on the harness terminals with the pins on the board connectors. Incorrect harness connection may result in faulty drive operation and may damage the equipment.

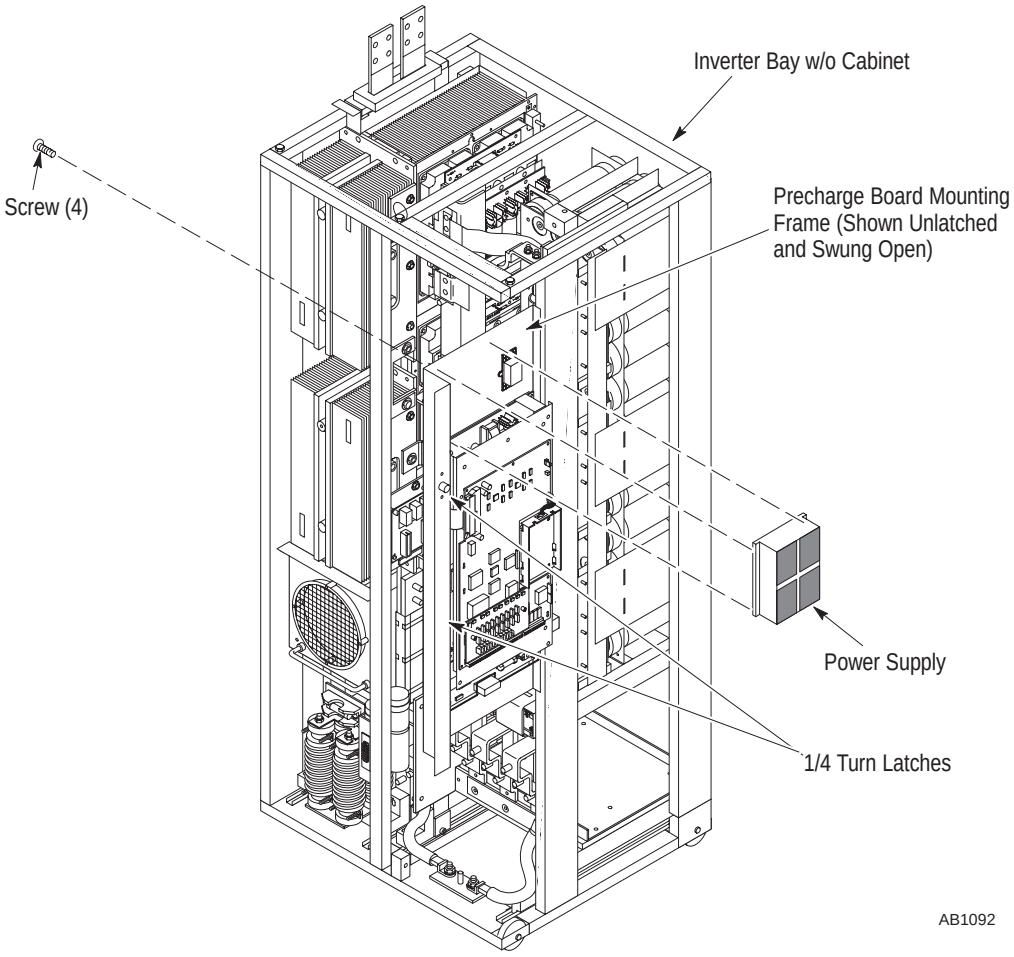
ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Replacing the Power Supply

Removal

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to *Electrostatic Discharge Precautions* in Chapter 3, *Access Procedures*.

Figure 5.7
Power Supply



1. Remove power and check for zero voltage in the drive. Refer to *Opening the Drive Enclosure* in Chapter 3, *Access Procedures*.

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify zero bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three bus fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

2. Release the two 1/4-turn latches on the Precharge Board Mounting Frame.
3. Swing Precharge Board Mounting Frame away from drive.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

4. Remove the cables from the power supply.
5. Remove the four screws fastening the Power Supply to the Precharge Board Mounting Frame.

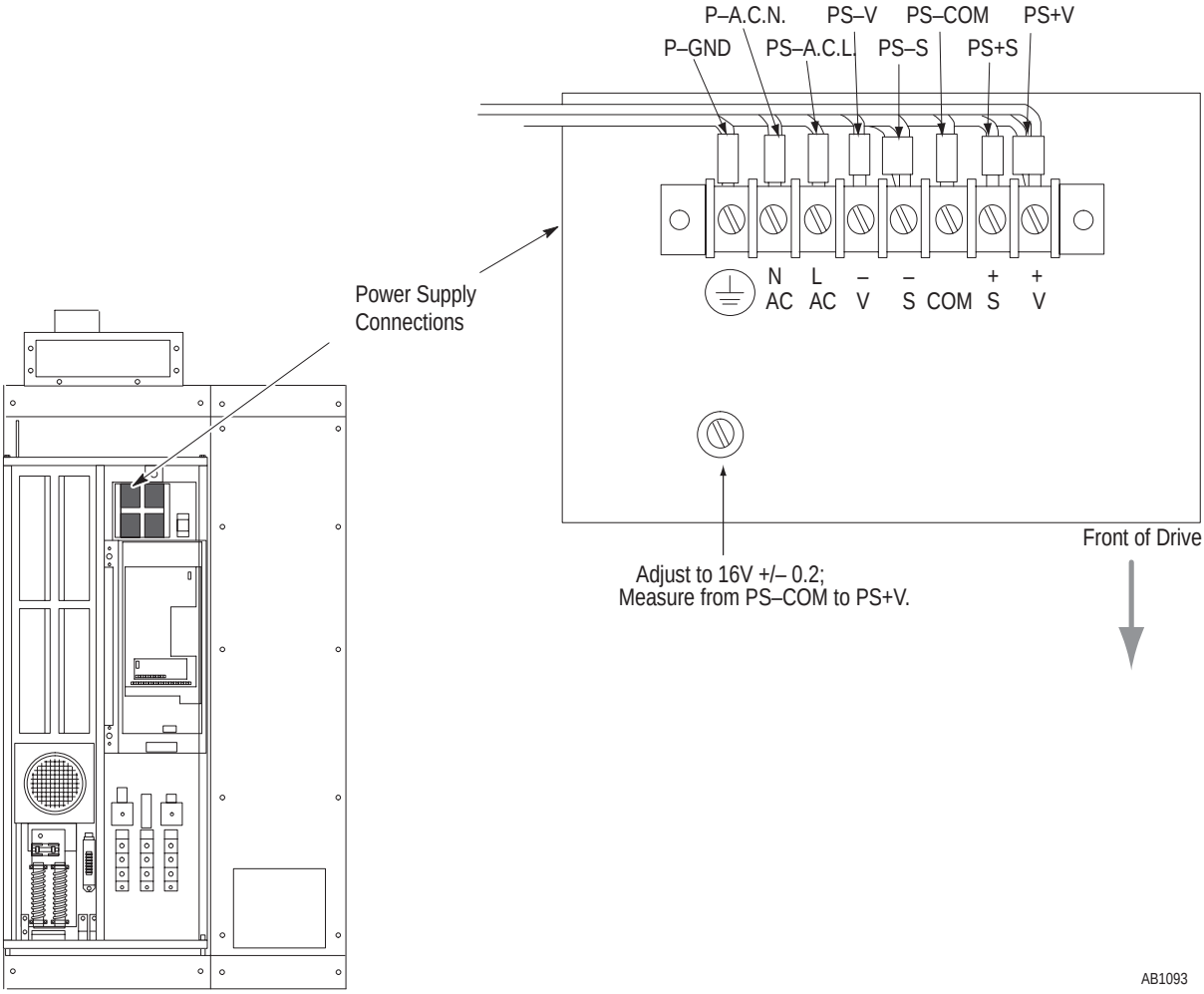
Installation

1. Install the Power Supply in reverse order of removal.
2. Make sure that the high voltage bus and the 120 volt power supply are both de-energized.

ATTENTION: A hazard of personal injury does exist. Depending on your system, the 120V separately-supplied power source may not be de-energized when you de-energize the high voltage bus. Make sure that both sources of power are completely de-energized.

3. Adjust voltage to 16 Volts. Refer to Figure 5.8.

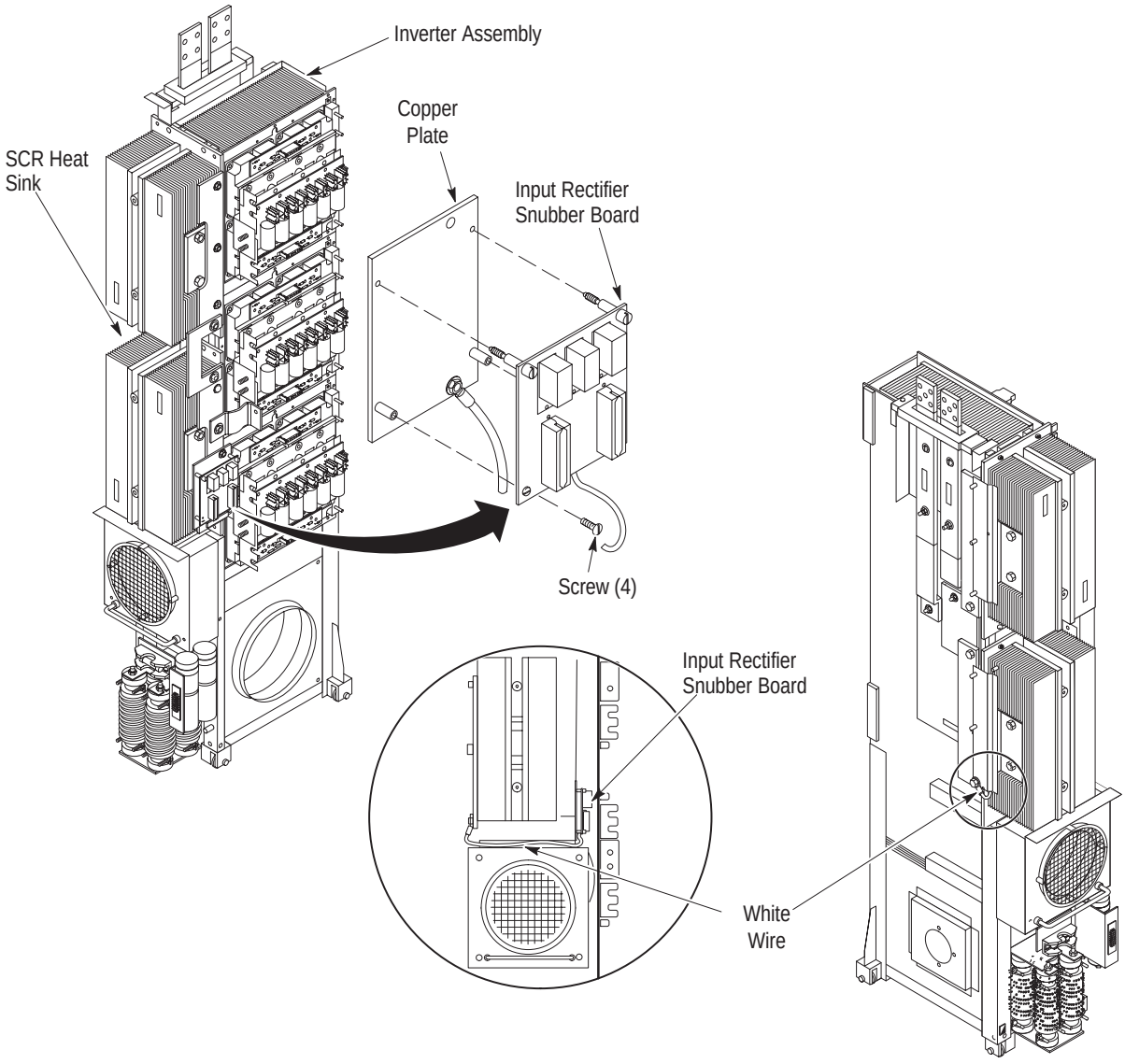
Figure 5.8
Power Supply Connections



Replacing an Input Rectifier Snubber Board

The Input Rectifier Snubber Boards are located on the Inverter Assembly, under the Guard, between the heat sinks and the vertical bus.

Figure 5.9
Input Rectifier Snubber Board



Removal

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to *Electrostatic Discharge Precautions* in Chapter 3, *Access Procedures*.

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify zero bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three bus fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

1. Remove power and check for zero voltage in the drive. Refer to *Opening the Drive Enclosure* in Chapter 3, *Access Procedures*.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

2. Remove the screws fastening the Input Rectifier Snubber Board to the Copper Plate.
3. Remove the nut from the stud on the other side of the SCR Heat Sink and disconnect the white Snubber Board wire from the stud. Refer to Figure 5.9.
4. Remove the Snubber Board.

Installation

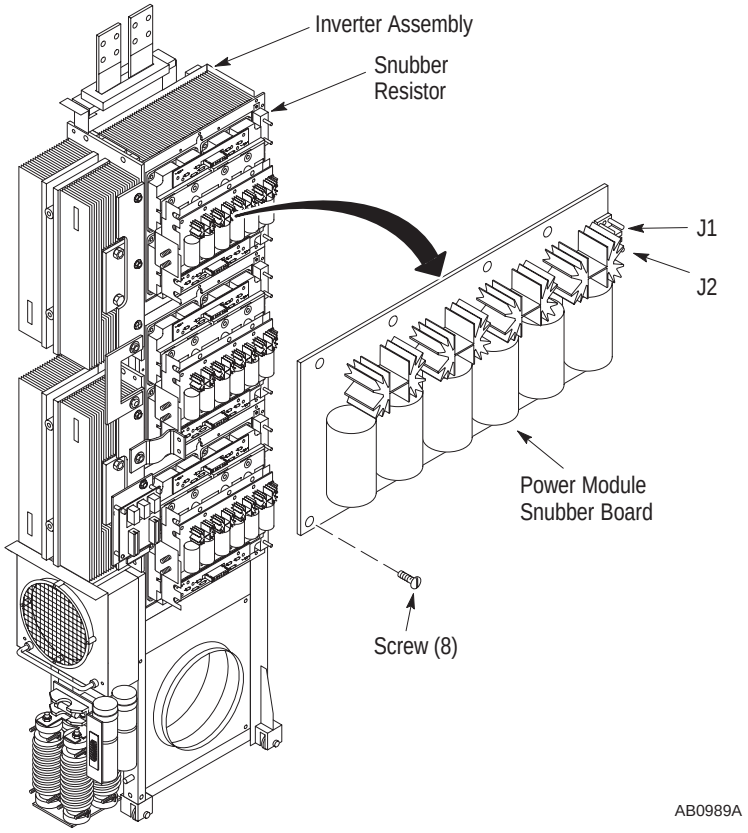
Install the Input Rectifier Snubber Board in reverse order of removal. Refer to Table 3.A – *Fastener Torque Specifications* in Chapter 3, *Access Procedures*.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Replacing a Power Module Snubber Board

The Power Module Snubber Boards are located on the heat sink at the back of the Inverter Assembly.

Figure 5.10
Power Module Snubber Board



Removal

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to *Electrostatic Discharge Precautions* in Chapter 3, *Access Procedures*.

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify zero bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three bus fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Perform the following procedures in Chapter 3, *Access Procedures*.
   - *Opening the Drive Enclosure*
   - *Removing the Control Board Mounting Plate*
   - R*emoving the Precharge Board Mounting Frame*
   - *Pulling the Inverter Assembly*
2. Remove the Snubber Resistor connections from the Snubber Board, J1 and J2.
3. Remove the screws fastening the Power Module Snubber Board to the Snubber Bus Bars.

Installation

ATTENTION: Do not substitute longer or shorter hardware when fastening the Power Module components to the Power Modules. Use the same size fastener to fasten the components as was originally used. Using different fastener lengths will damage the Power Modules.

Install the Power Module Snubber Board in reverse order of removal. Refer to Table 3.A – *Fastener Torque Specifications* in Chapter 3, *Access Procedures*.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Replacing a Power Module

The Power Modules are located on the heat sink toward the back of the Inverter Assembly. If one or more Power Modules is replaced, you must check the Power Module Snubber Board, the Common Bus Precharge Board, and the Gate Driver Board.

Removal

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to *Electrostatic Discharge Precautions* at the beginning of this chapter.

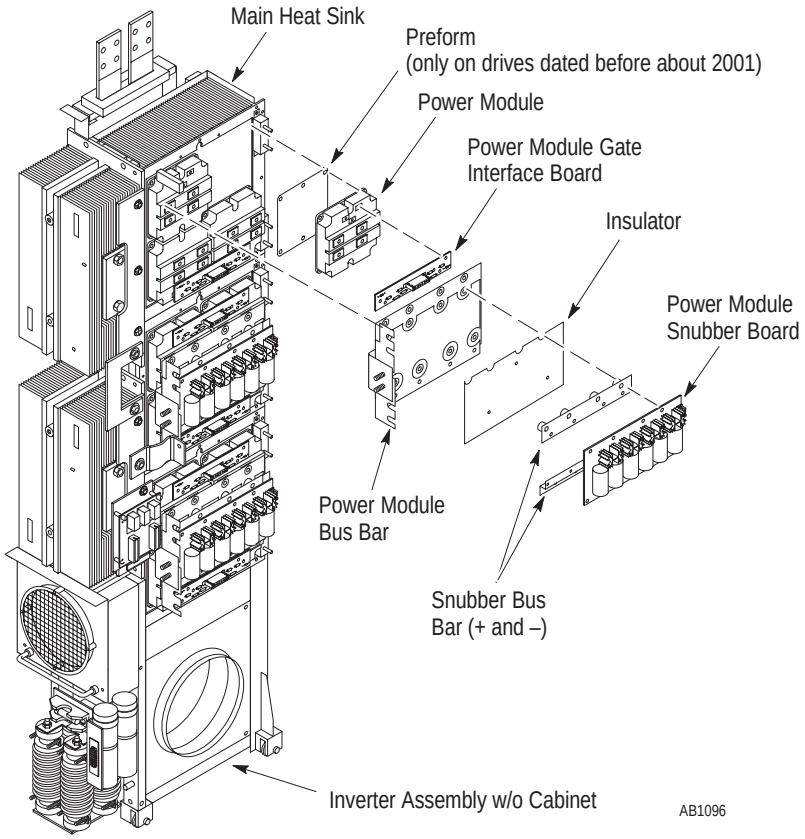
ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify zero bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three bus fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Perform the following procedures in Chapter 3, *Access Procedures*.
   - *Opening the Drive Enclosure*
   - *Removing the Control Board Mounting Plate*
   - R*emoving the Precharge Board Mounting Frame*
   - *Pulling the Inverter Assembly*
2. Referring to *Removing the Power Module Snubber Board* in this chapter, remove the Power Module Snubber Board.
3. Remove the screws fastening the positive and negative Snubber Bus Bars to the Power Module Bus Bar.
4. Remove the screws fastening the Power Module Bus Bar to the Power Modules.
5. Carefully remove the bus bar. Do not damage the Insulator.

6. Remove the screws fastening the Power Module Gate Interface Board to the Power Modules.
7. Remove the Power Module Gate Interface Boards.
8. Follow the torque sequence, as illustrated in Chapter 3, *Access Procedures*, Figure 3.3, and remove the screws fastening the Power Module to the heat sink.
9. Remove and discard the Preform, if present.

Figure 5.11
Power Modules



Installation

1. Clean all surfaces between the Power Module and the Main Heat Sink using a soft, clean cloth.
2. Apply layer of thermal grease (supplied) between Power Module and the Main Heat Sink. Discard old Preform, if present.
3. Install the Power Module in reverse order of removal. Refer to *Fastener Torque Specifications* in Chapter 3, *Access Procedures*.

ATTENTION: Do not substitute longer or shorter hardware when fastening the Power Module components to the Power Modules. Use the same size fastener to fasten the components as was originally used. Using different fastener lengths will damage the Power Modules.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Replacing a Power Module Snubber Resistor

The Power Module Snubber Resistors are located on the Main Heat Sink at the back of the Inverter Assembly.

Removal

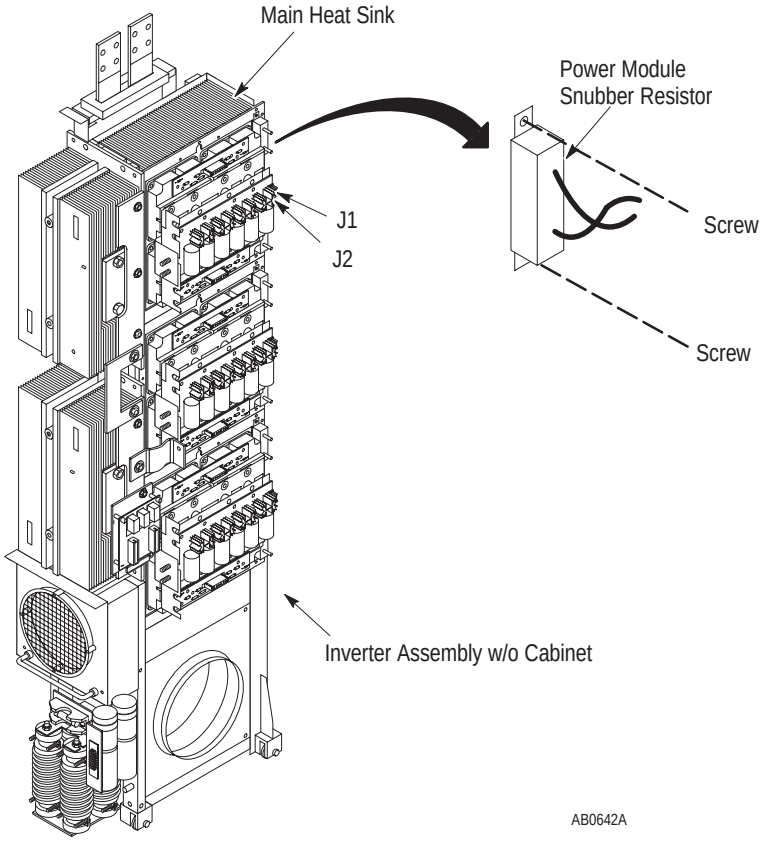
ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to *Electrostatic Discharge Precautions* at the beginning of this chapter.

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify zero bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three bus fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Perform the following procedures in Chapter 3, *Access Procedures*.
   - *Opening the Drive Enclosure*
   - *Removing the Control Board Mounting Plate*
   - R*emoving the Precharge Board Mounting Frame*
   - *Pulling the Inverter Assembly*
2. Remove the Power Module Snubber Resistor connectors from the J1 and J2 connectors on the Power Module Snubber Board.
3. Remove the screws fastening the Power Module Snubber Resistor to the Main Heat Sink.

Figure 5.12
Power Module Snubber Resistor



Installation

Install the Power Module Snubber Resistor in reverse order of removal.

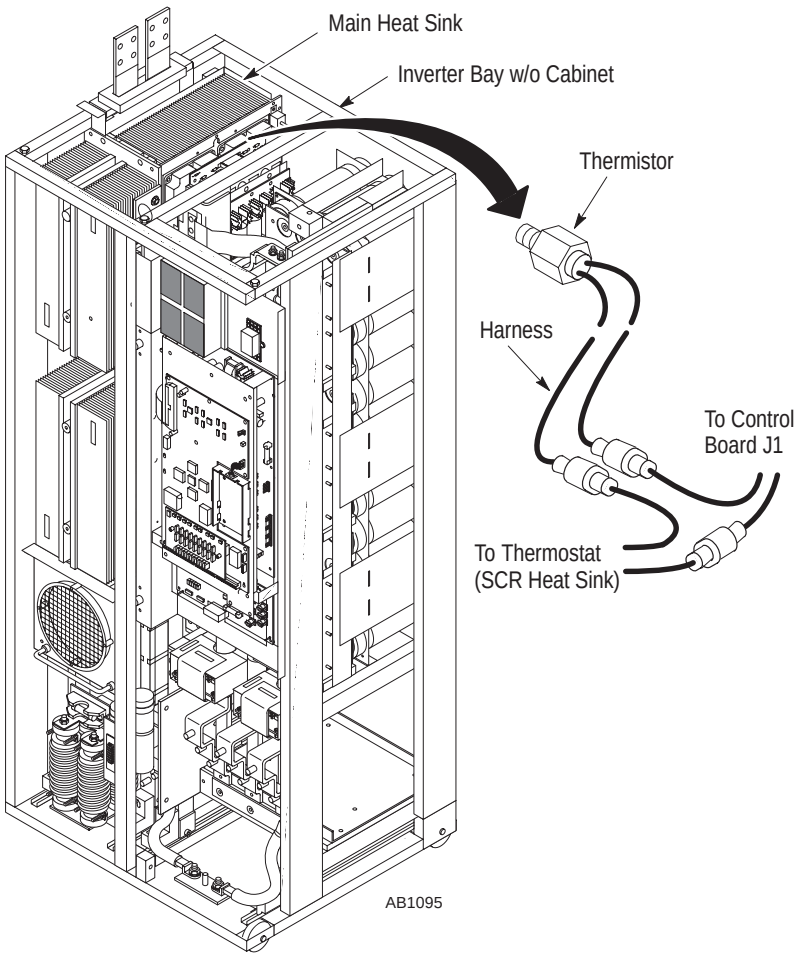
Important: Install the resistors with the markings to the right (outside) for easier future reference.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Replacing a Thermistor

The Thermistor is located at the top of the Main Heat Sink in the Inverter Assembly.

Figure 5.13
Thermistor



Removal

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to *Electrostatic Discharge Precautions* in Chapter 3, *Access Procedures*.

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify zero bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three bus fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

1. Remove power and check for zero voltage in the drive. Refer to *Opening the Drive Enclosure* in Chapter 3, *Access Procedures*.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

2. Disconnect Thermistor connectors from harness. Refer to Figure 4.9.
3. Remove the Thermistor.

Installation

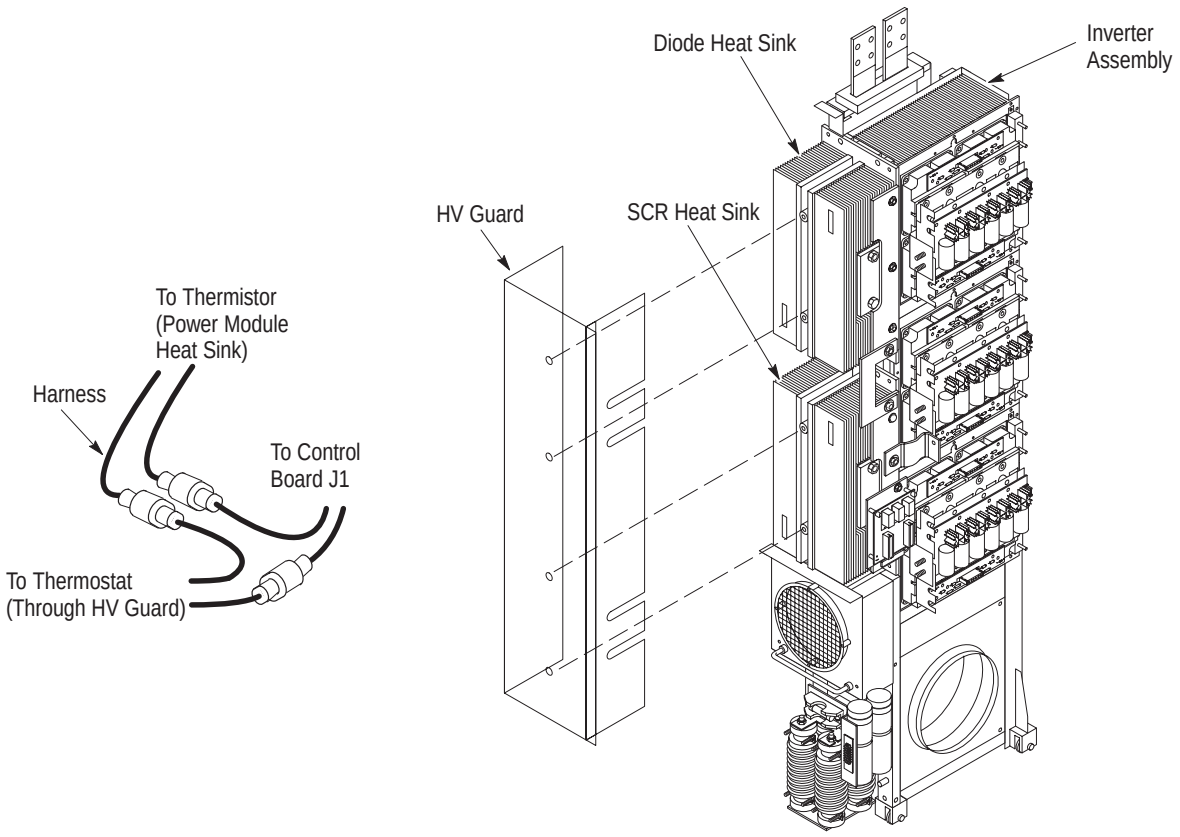
Install the Thermistor in reverse order of removal. Refer to *Fastener Torque Specifications* in Chapter 3, *Access Procedures*.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Replacing a Diode, SCR or Thermostat

The Diode and SCR Heat Sink Assemblies are mounted on the front of the Inverter Assembly. The SCR Heat Sink Assembly also contains the Thermostat. Access to these components does not require removal of the Inverter Assembly from the Inverter Bay. Figure 3.17 shows the Inverter Assembly removed for clarity.

Figure 5.14
Diode and SCR



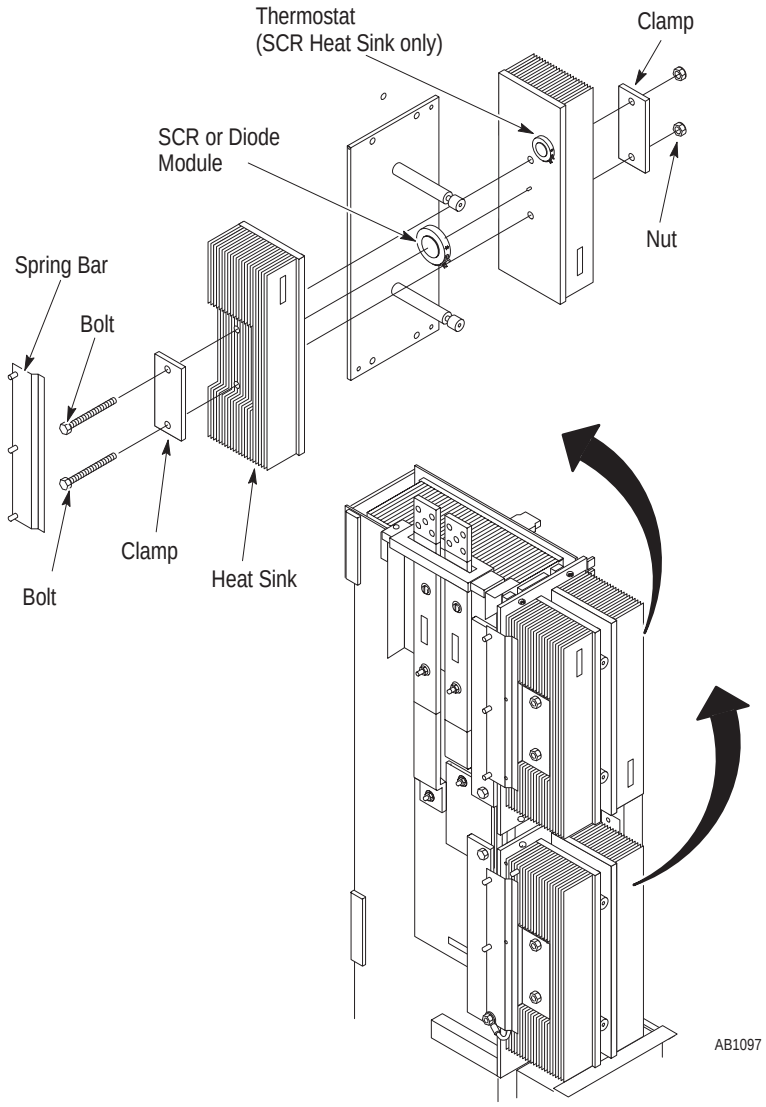
Removal

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to *Electrostatic Discharge Precautions* at the beginning of this chapter.

1. Remove power and check for zero voltage in the drive. Refer to *Opening the Drive Enclosure* in Chapter 3. *Access Procedures.*
2. A harness joins the Thermistor (Power Module) and Thermostat (SCR) to the Control Board (Figure 3.17). Disconnect the Thermostat leads from this harness.

3. Remove the screws on the HV Guard.
4. Reach behind the HV Guard and remove the leads from the SCR.
5. Pass the leads removed in the above step through the hole in the HV Guard in order to free and remove the guard.
6. Remove the heat sink clamp nuts (Figure 5.15).

Figure 5.15
Heat Sink Detail



7. With the Clamps removed, it is normally possible to separate the Heat Sink halves enough to remove the SCR and Thermostat, or the Diode. As an alternative, refer to Chapter 3, *Access Procedures* and perform *Removing SCR and Diode Heat Sinks*.
8. Note the polarity of the Diode or SCR and remove the defective component.

Installation

Refer to Table 3.A – *Fastener Torque Specifications* in Chapter 3, *Access Procedures*.

1. Route the SCR leads (from the Common Bus Precharge Board) in through the hole in the HV Guard, and connect the leads to the SCR.
2. Apply two drops of silicone oil to each side or face of the new Diode or SCR.
3. Clean any dirt off of the original heat sink mounting surfaces.
4. Install the new Diode or SCR, with the same polarity as the original component, in the heat sink (refer to Figure 5.15).

Important: A pin on the Heat Sink centers the SCR. Verify that the SCR is centered on the pin. When properly centered he SCR should rotate freely about the pin.

5. Tighten the clamp nuts, while holding the heat sinks flat against the precharge back-up plate.
6. If the heat sinks were removed from the Inverter Assembly, re-install. Refer to *Removing SCR and Diode Heat Sinks*, in Chapter 3, *Access Procedures*.
7. Route the Thermostat harness out through the hole in the HV Guard and connect to the harness coming from the Thermistor and Control Board.
8. Reinstall the four screws that hold the HV Guard in place.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Replacing Inverter Bay Fan Assemblies

Two fans are located at the bottom of the Inverter Assembly. Both fans can be replaced without pulling out the Inverter Assembly.

Removal

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to *Electrostatic Discharge Precautions* at the beginning of this chapter.

1. Remove power and check for zero voltage in the drive. Refer to *Opening the Drive Enclosure* in Chapter 3, *Access Procedures*.

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify zero bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three bus fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

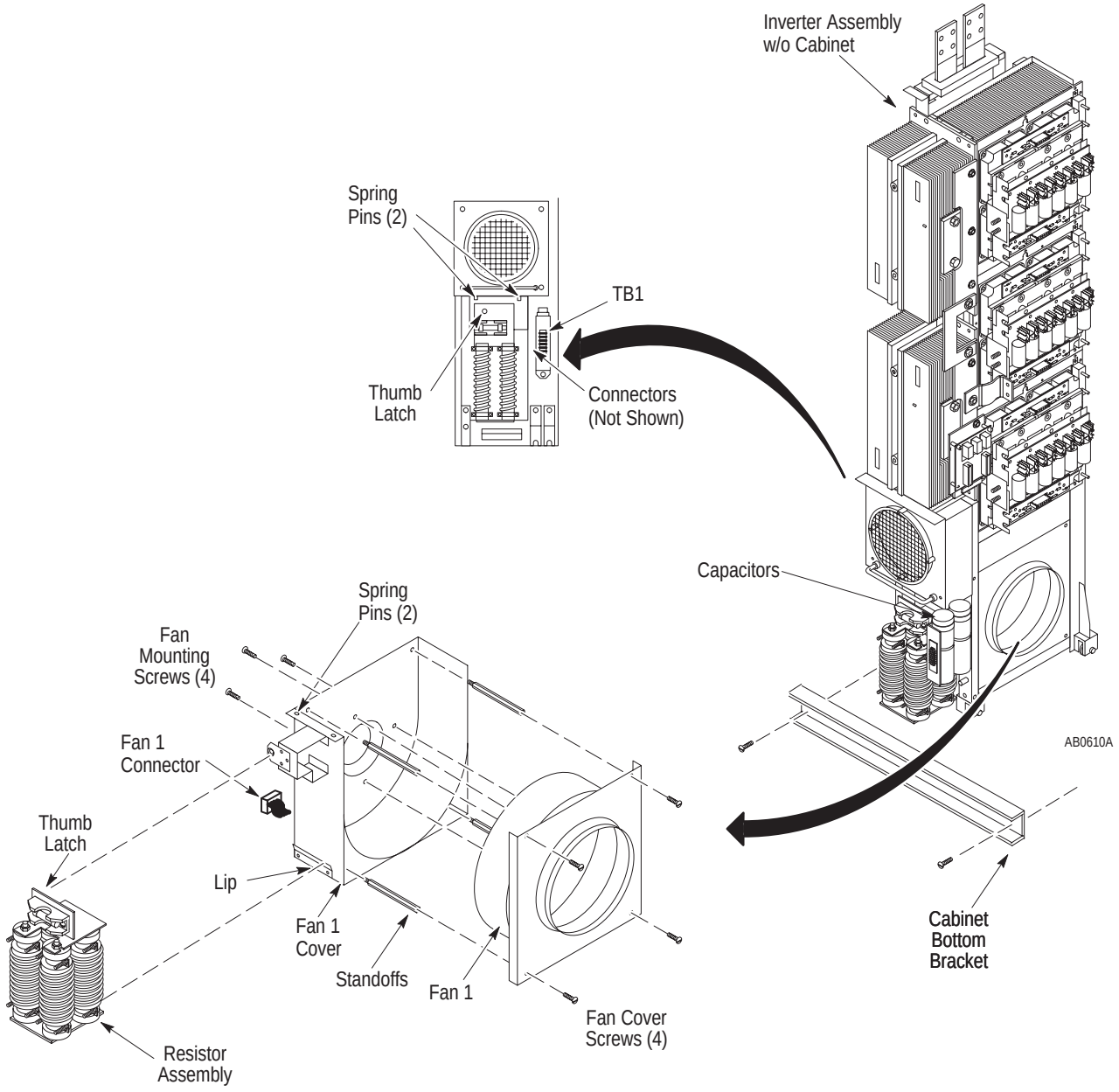
Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

Refer to Figure 5.16, and the following steps to remove Fan 1.

1. Disconnect wires leading to the resistors on the resistor assembly.
2. Disconnect Fan 1 and Fan 2 connectors.
3. Open thumb latch on Resistor Assembly.
4. Remove Resistor Assembly by tilting the top of the assembly forward and then lifting. (You must clear the lip that catches on the bottom rear of the assembly.)
5. Remove either the Cabinet Bottom Bracket or Fan 2 to get the clearance required to remove Fan 1.
6. Pull down on both spring pins fastening Fan 1 to the Inverter Assembly.

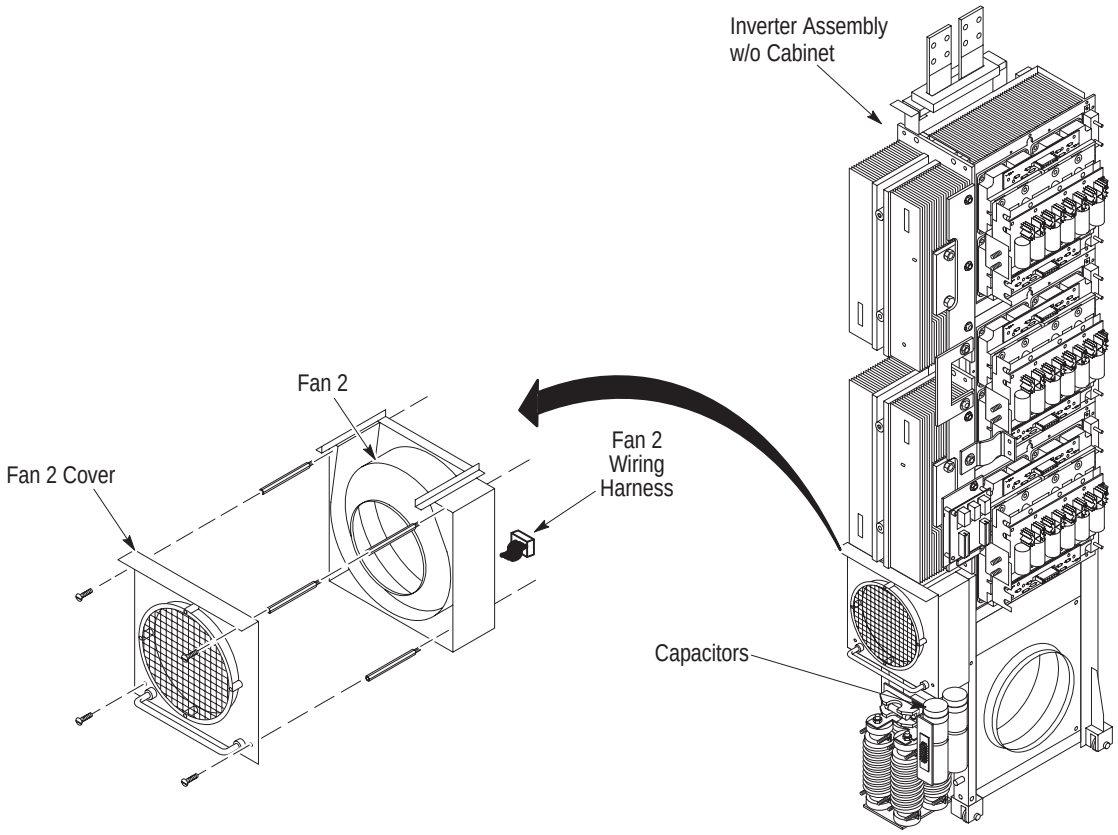
7. Pull Fan 1 toward you to remove it. (You may have to also disconnect the connectors for the capacitors in order to get enough clearance to remove the fan.)
8. Remove four bolts on the fan front cover to remove the fan cover.
9. Remove four bolts on the back cover to release the fan.

Figure 5.16
Fan 1 Assembly



Refer to Figure 5.17, and the following steps to remove Fan 2.

Figure 5.17
Fan 2 Assembly



1. Remove the screws fastening the Fan 2 Cover to Fan 2.
2. Remove the standoffs that fasten Fan 2 to the Inverter Assembly.
3. Disconnect the Fan 2 wiring harness.
4. Remove fan from assembly.

Installation

Install Fan 1 and Fan 2 in reverse order of removal.

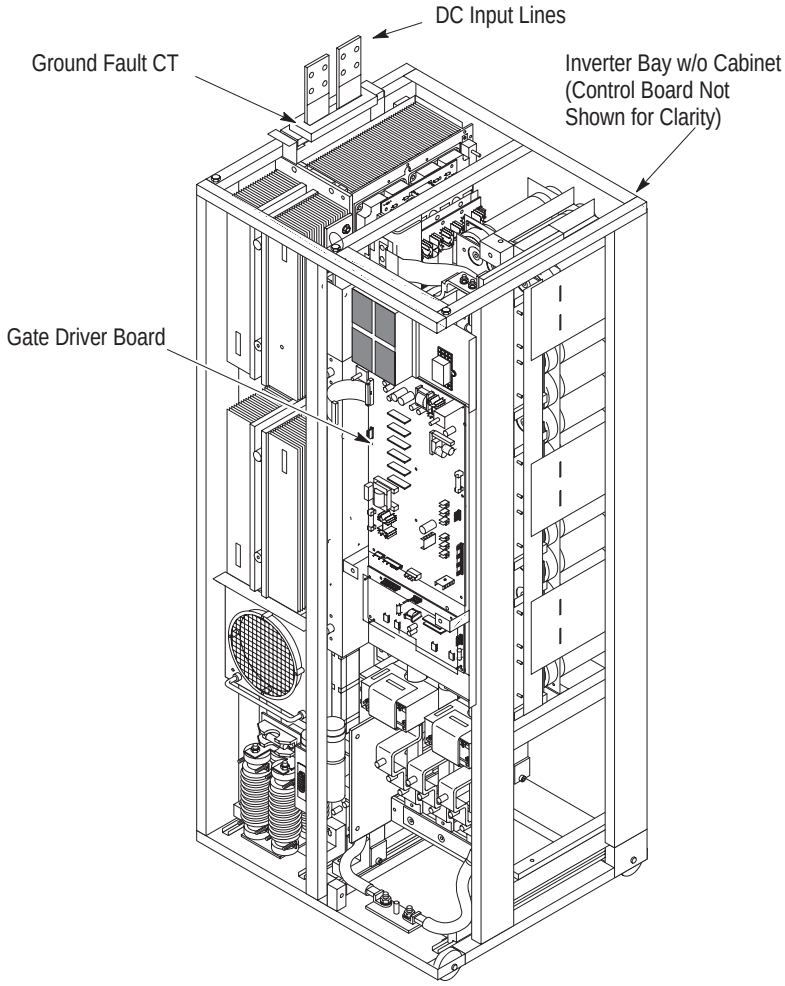
ATTENTION: Take care to avoid pinching any wires as the fan assemblies are mounted. Also, keep wiring clear of the the Resistors in the Resistor Assembly.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Replacing the Ground Fault CT

The Ground Fault CT is located at the top of the Inverter Assembly.

Figure 5.18
Ground Fault CT



Removal

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to *Electrostatic Discharge Precautions* at the beginning of this chapter.

1. Remove power and check for zero voltage in the drive. Refer to *Opening the Drive Enclosure* in Chapter 3, *Access Procedures*.

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify zero bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three bus fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

2. Remove the buses at the DC Input Lines.
3. Disconnect the Ground Fault CT harness from the harness that goes to the Gate Driver Board.
4. Remove the nut and washer on the lead bolted to the top of the Inverter Assembly.
5. Cut the cable ties and slide the Ground Fault CT up and off the DC Input Lines.

Installation

Install the Ground Fault CT in reverse order of removal. Refer to *Fastener Torque Specifications* in Chapter 3 – *Access Procedures*.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

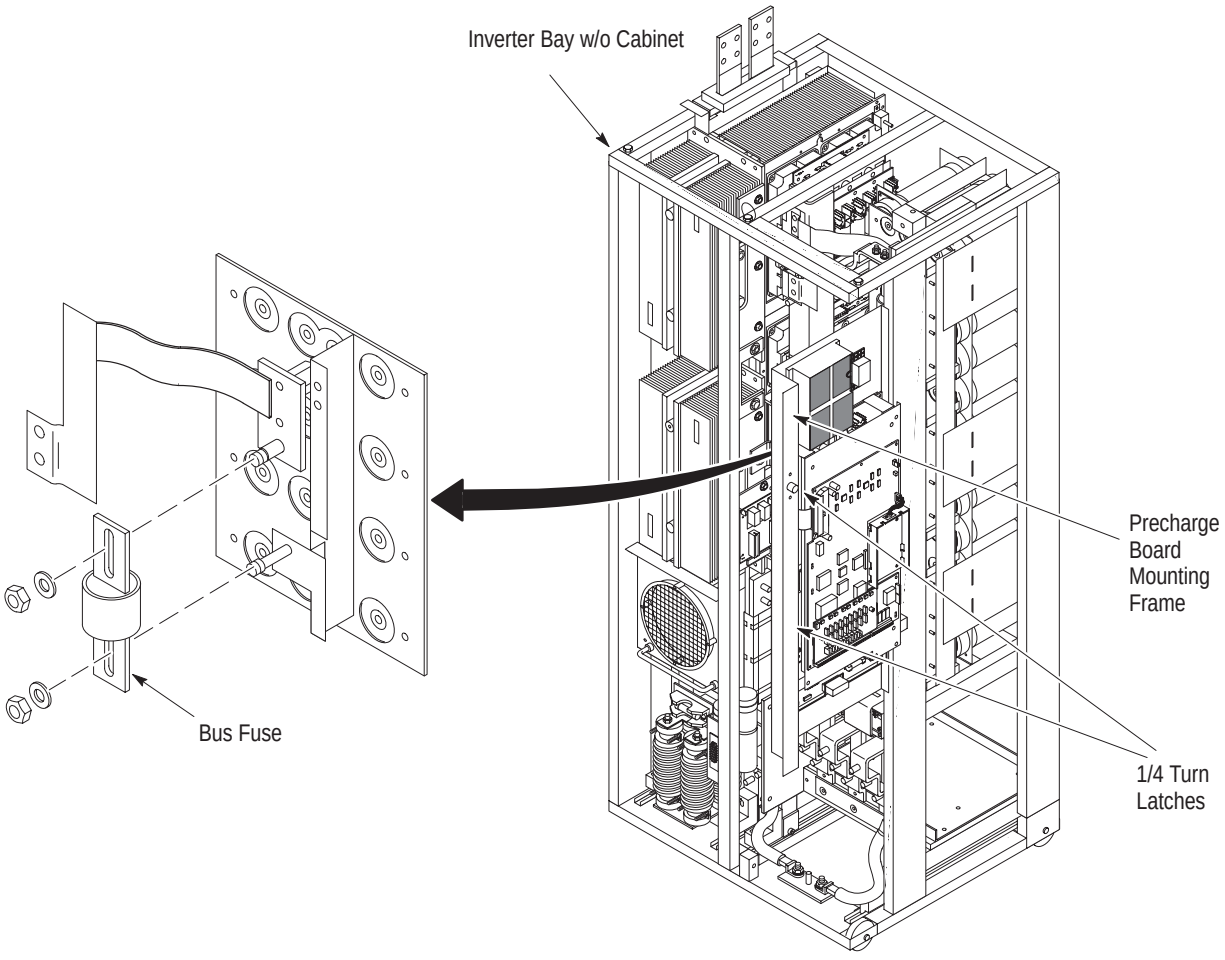
Replacing Bus Fuses

The Bus Fuses are located on the Transitional Bus Bar Assembly.

If just one of the three Bus Fuses fails, suspect a failure in the associated set of Bus Capacitors. Refer to *Replacing Bus Capacitors* in this chapter.

Removal

Figure 5.19
Bus Fuse



ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to *Electrostatic Discharge Precautions* at the beginning of this chapter.

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify zero bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three bus fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

1. Remove power and check for zero voltage in the drive. Refer to *Opening the Drive Enclosure* in Chapter 3, *Access Procedures*.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

2. Open the Precharge Board Mounting Frame: Release 1/4 turn latches and the swing door open.
3. Remove the nuts and washers fastening the Bus Fuse to the drive.

Installation

Install the Bus Fuse in reverse order of removal. Refer to Chapter 3, *Access Procedures, Fastener Torque Specifications*.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Replacing Current Transducers (LEMs)

The Current Transducers (also known by the supplier's name, LEM) are located in the Capacitor Bank Assembly above the Motor Terminals.

Removal

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to *Electrostatic Discharge Precautions* at the beginning of this chapter.

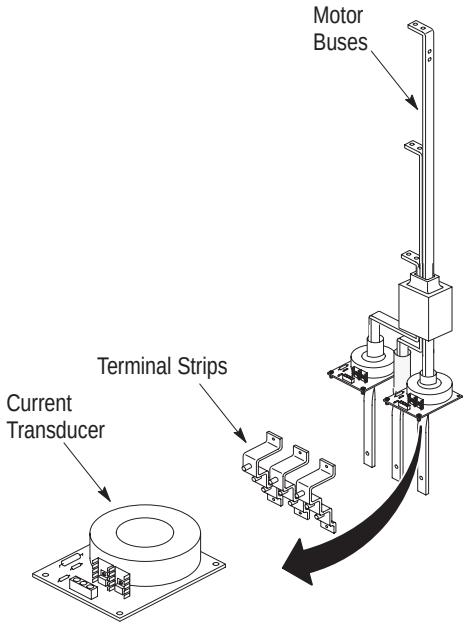
ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify zero bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three bus fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

Access the Current Transducers:

1. Perform the following procedures in Chapter 3, *Access Procedures*.
   - *Opening the Drive Enclosure*
   - *Removing the Control Board Mounting Plate*
   - *Removing the Precharge Board Mounting Frame*
   - *Removing the Motor Buses*

Figure 5.20
Current Transducers



Remove the Current Transducer:

1. Remove the Terminal Strip (stairstep shaped bar) from each Motor Bus.
2. Tilt the Motor Buses out at the bottom. (It is not necessary to remove the flex buses from the top of the Motor Buses.)
3. Slide the Current Transducer off the bottom of the Motor Bus.

Installation

Install the Current Transducers in reverse order of removal. Refer to *Fastener Torque Specifications* in Chapter 3, *Access Procedures*.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Replacing Bus Capacitors

The Bus Capacitor Bank is located on the right side of the Inverter Bay, in the Capacitor Bank Assembly. Replace any capacitors that show signs of swelling, leaks, or burn marks.

Removal

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to *Electrostatic Discharge Precautions* in Chapter 3, *Access Procedures*.

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify zero bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three bus fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Perform the following procedures in Chapter 3, *Access Procedures*.
   - *Opening the Drive Enclosure*
   - *Removing the Control Board Mounting Plate*
   - *Removing the Precharge Board Mounting Frame*
   - *Pulling the Capacitor Bank Assembly*
   - *Removing the Motor Buses*

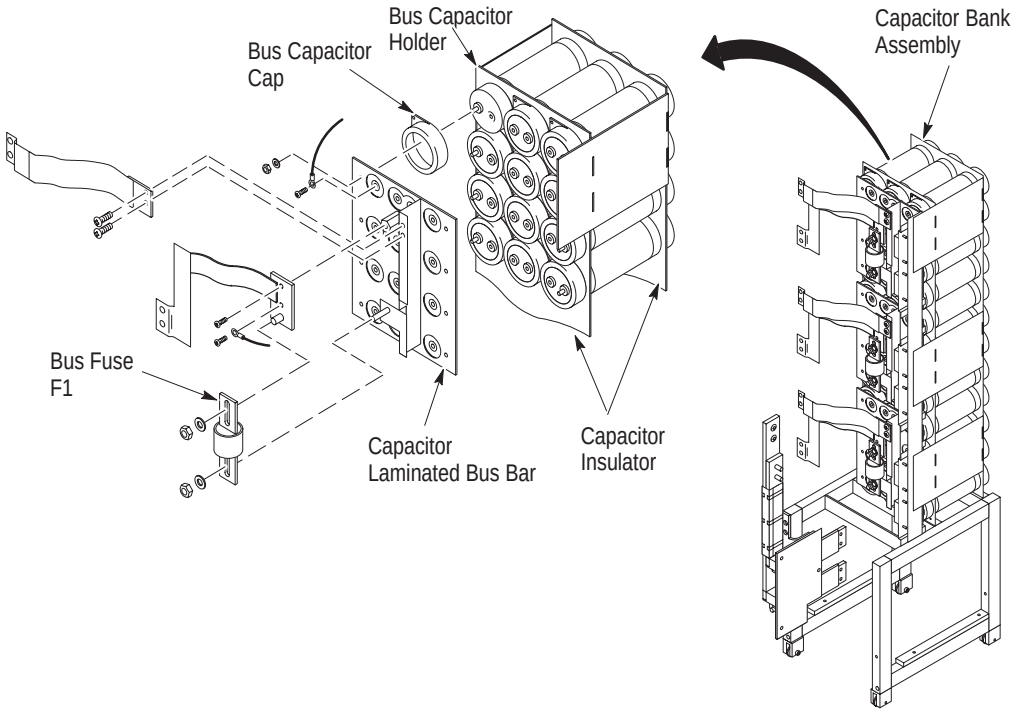
Referring to Figure 5.21 and the following steps, access the Capacitors:

1. Remove the screws fastening the wires from the Balancer Plate assembly to the capacitors.
2. Remove the screws, nuts, and washers fastening the Capacitor Laminated Bus Bar to the capacitors.
3. Remove the Capacitor Laminated Bus Bar and attached components.

4. Remove the Bus Capacitor Caps at the four corners of each capacitor insulator.

5. Remove the capacitors from the drive.

Figure 5.21
Bus Capacitor Bank

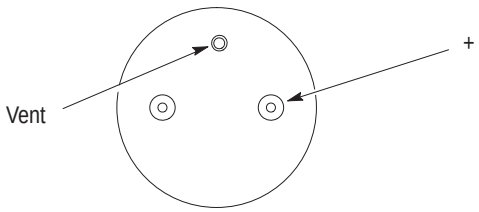


Installation

1. Install the capacitor assembly in reverse order of removal. Refer to *Fastener Torque Specifications* in Chapter 3, *Access Procedures*.

Important: Position the notch and vent hole on the Bus Capacitors to the top of the drive. Refer to Figure 5.22.

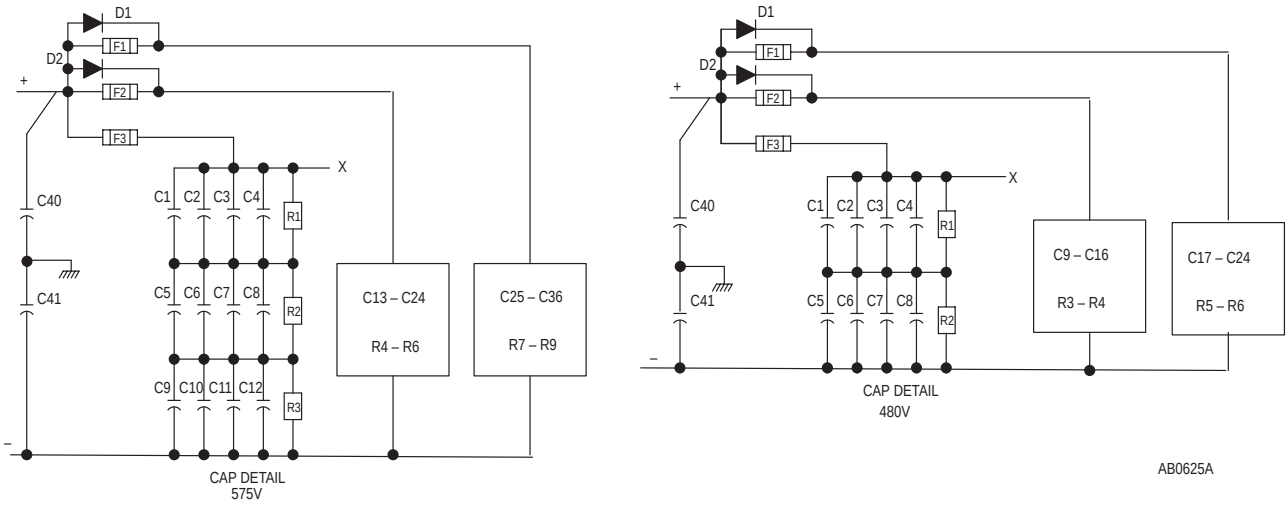
Figure 5.22
Capacitor Orientation



2. Connect the Volt-Sharing Resistors to the Bus Capacitors according to the schematic in Figure 4.5. Refer to the schematic diagrams in this manual for more information on component configurations.

ATTENTION: Capacitors not installed correctly will explode or vent and may cause death or serious injury. Observe correct polarities.

Figure 5.23
Volt-Sharing Resistor Connections to Bus Capacitors



ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Replacing Volt-Sharing Resistors and Dual Diodes

The Volt-Sharing Resistors and Dual Diodes are mounted on the Balancer Plate Assembly. This assembly is located on the right wall of the Capacitor Bank Assembly.

Removal

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to *Electrostatic Discharge Precautions* in Chapter 3, *Access Procedures*.

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify zero bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three bus fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

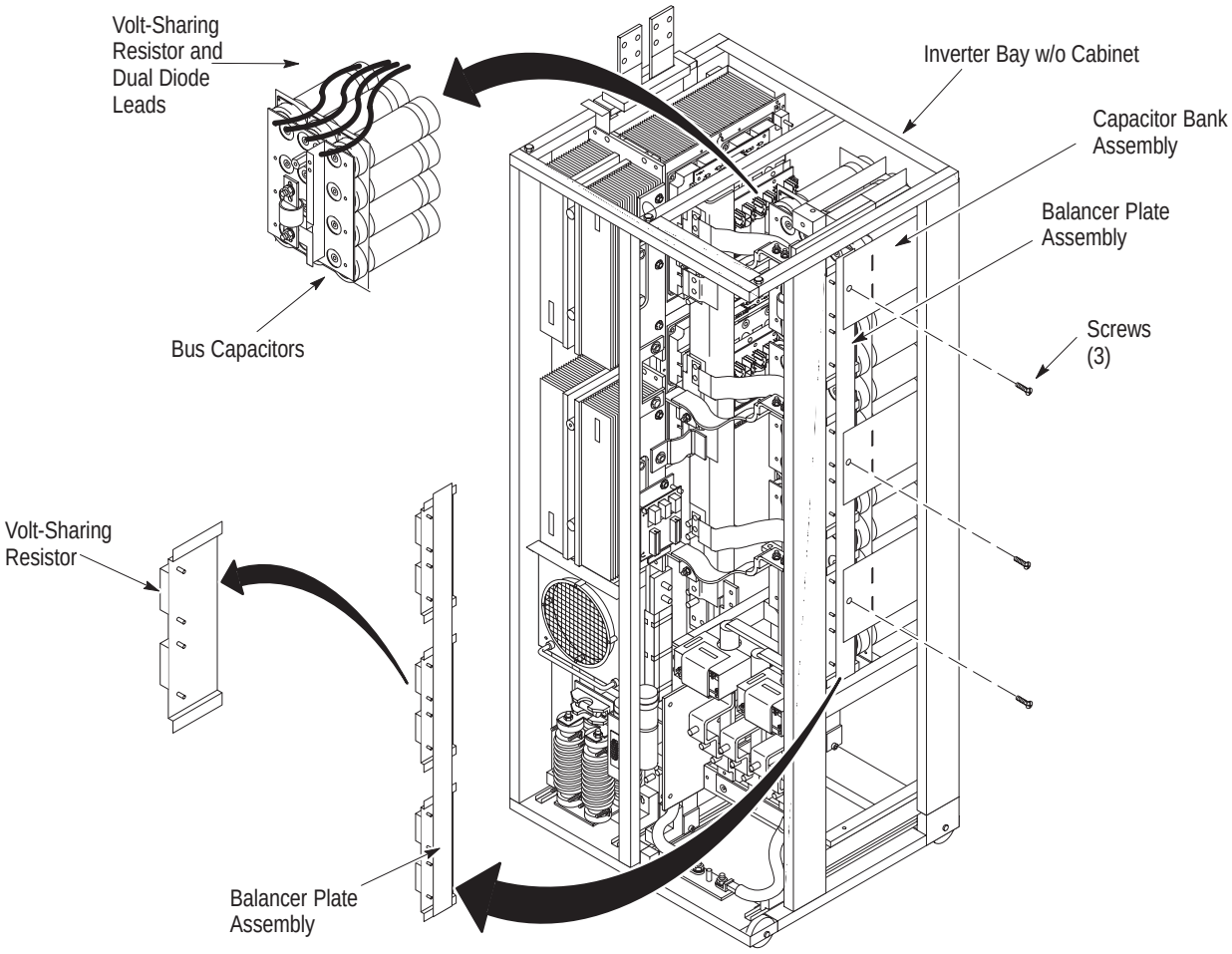
Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Perform the following procedures in Chapter 3, *Access Procedures*.
   - *Opening the Drive Enclosure*
   - *Removing the Control Board Mounting Plate*
   - *Removing the Precharge Board Mounting Frame*

Referring to Figure 4.6, remove the appropriate Volt-Sharing Resistors and/or Dual Diodes.

2. Remove the appropriate Resistor leads from the Bus Capacitors.
3. Remove the appropriate Diode leads.
4. Remove the three screws holding the Balancer Plate Assembly to the side of the Capacitor Assembly.
5. Remove the Volt-Sharing Resistors and Dual Diodes from the Balancer Plate Assembly.

Figure 5.24
Balancer Plate Assembly



Installation

1. Install the capacitor assembly in reverse order of removal. Refer to *Fastener Torque Specifications* in Chapter 3, *Access Procedures*.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Replacing the Converter Bay Door Fan

The Converter Bay is configured to each order. The steps and illustrations in this procedure are typical.

Removal

1. Remove power and check for zero voltage in the drive. Refer to *Opening the Drive Enclosure* in Chapter 3, *Access Procedures*.

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify zero bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three bus fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

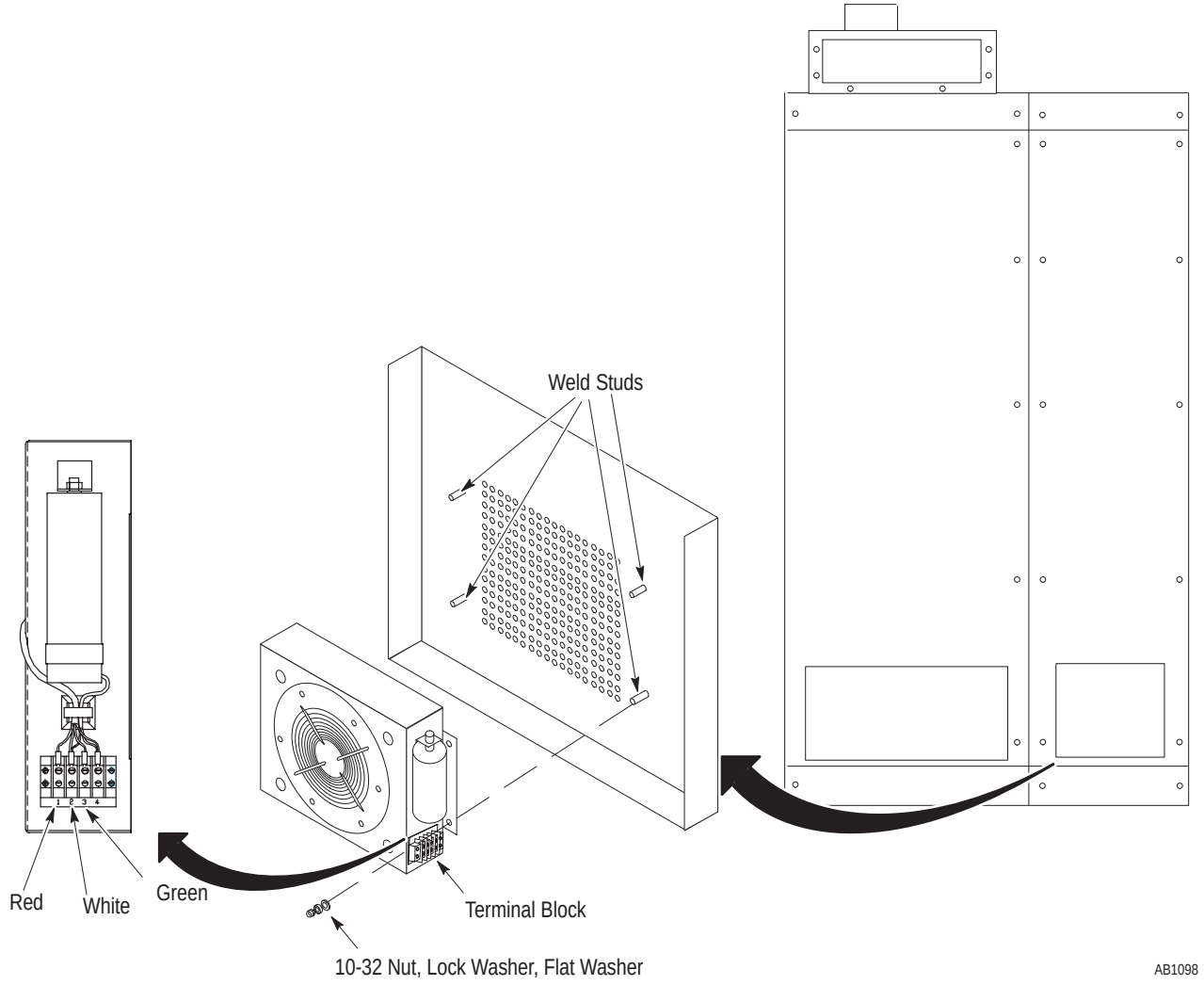
Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

2. Remove the wires from the terminal block located on the right side of the fan assembly.
3. Remove the nut, lock washer, and flat washer from each of the four weld studs.
4. Remove the fan assembly.

Installation

1. Place the new fan assembly on to the four weld studs. The terminal block should be located on the lower right side of the fan assembly when the assembly is correctly placed on the door.
2. Place the flat washer, lock washer, and nut on the four weld studs to hold the fan in place.

Figure 5.25
Converter Bay Door Fan



3. Attach the wires to the terminal block located on the side of the fan assembly as follows:

- The red (or yellow/red) wire goes to terminal 1.
- The white (or yellow/white) wire goes to terminal 2.
- The green wire goes to terminal 3.

Refer to Figure 5.25 for the locations of the terminal block and weld studs and for the wiring information.

Replacing Converter Thermal Switches

The Converter Bay is configured to each order. The steps and illustrations in this procedure are typical. Three Converter Thermal Switches are mounted on the Bridge Heat Sink located in the Converter Bay.

Removal

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to *Electrostatic Discharge Precautions* at the beginning of this chapter.

1. Remove power and check for zero voltage in the drive. Refer to *Opening the Drive Enclosure* in Chapter 3, *Access Procedures*.

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify zero bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three bus fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

2. Remove the L-shaped bus bar that is located over the thermal switch you need to replace. (Remove the the flex bus from the L-shaped bus bar if necessary.)
3. Remove the power wires from the thermal switch.
4. Remove the thermal switch.

Installation

Refer to *Fastener Torque Specifications* in Chapter 3, *Access Procedures*.

1. Thread the new thermal switch by hand until it is snug.

Figure 5.26
Thermal Switches

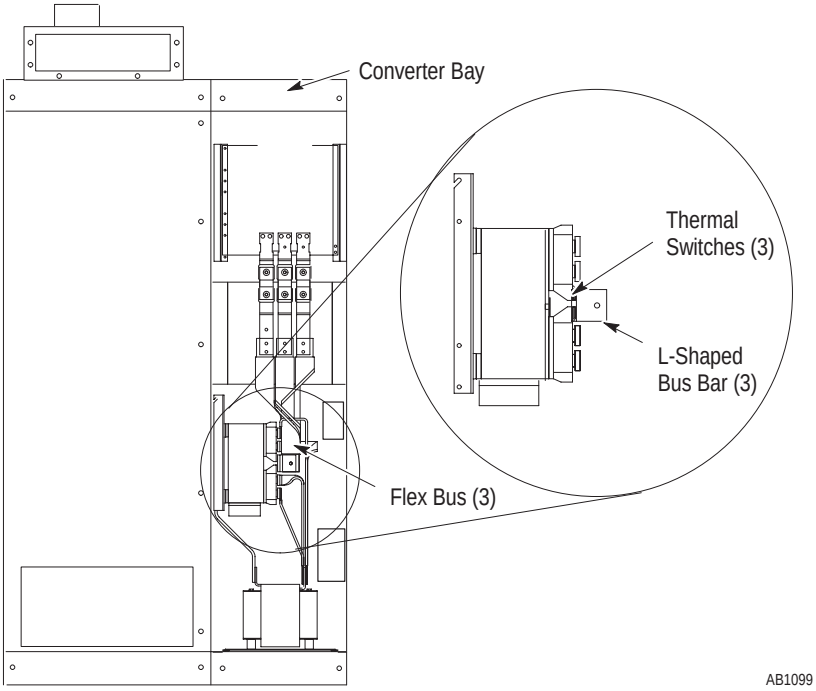
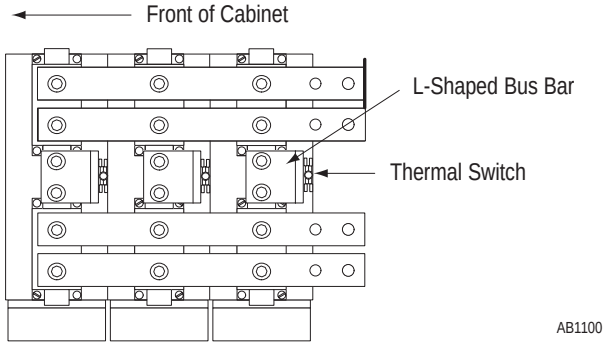


Figure 5.27
Thermal Switches – Side View



2. Tighten the screw on the thermal switch.

3. Bolt the L-shaped bus bar to the diode with two bolts.

4. Connect the power wires to the new thermal switch. It is not important which power wire is attached to which end of the thermal switch.

5. If not connected, connect the flex bus to the L-shaped bus bar.

Replacing Converter Fans

The Converter Bay is configured to each order. The steps and illustrations in this procedure are typical. Three Converter Fans are located beneath the Bridge Heat Sink in the Converter Bay.

Removal

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to *Electrostatic Discharge Precautions* at the beginning of this chapter.

1. Remove power and check for zero voltage in the drive. Refer to *Opening the Drive Enclosure* in Chapter 3, *Access Procedures*.

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify zero bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three bus fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

2. Remove the 115V power supply and neutral wires from the fan.
3. Using a thin, hex head driver, remove the screws and lock washers that secure the fan.
4. Remove the fan and fan spacer.

Figure 5.28
Converter Fans

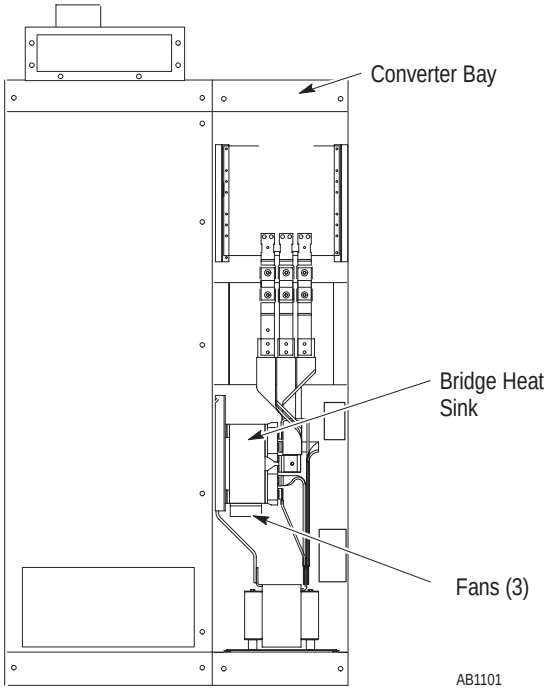
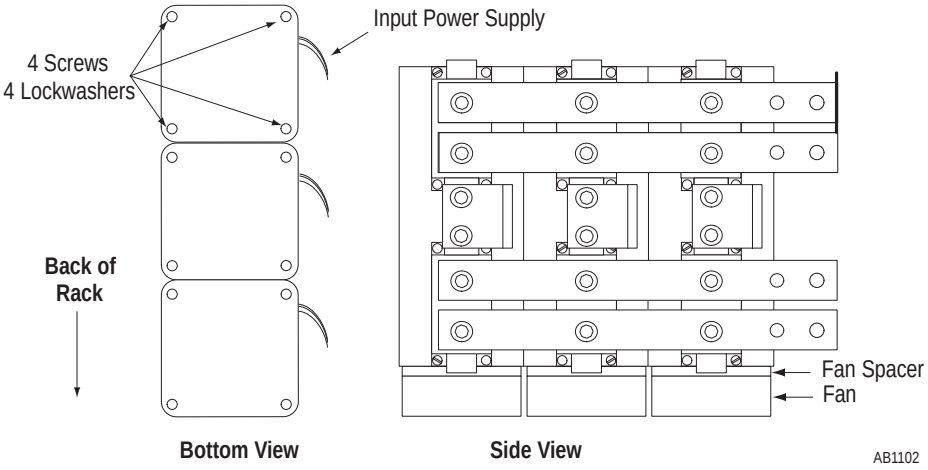


Figure 5.29
Converter Fans (Bottom and Side Views)



Installation

Refer to *Fastener Torque Specifications* in Chapter 3, *Access Procedures*.

1. Put the new fan in place, make sure to align the holes in the bridge with the holes in the four corners of the fan and fan spacer.

Important: Make sure that the arrows on the fan are pointing toward the top of the cabinet.

2. Insert screws and lock washers in the four corners and tighten the screws.
3. Attach the power supply and neutral wires to the fan.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Replacing Converter Diodes

The Converter Bay is configured to each order. The steps and illustrations in this procedure are typical. Six Converter Diodes are located on the Bridge Heat Sink in the Converter Bay.

Refer to Table 5.B for replacement diode numbers.

Table 5.B
Diode Numbers

Use this catalog number:	With:
1336-BK-SP9A	480V
1336-BK-SP10A	575V

Removal

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to *Electrostatic Discharge Precautions* at the beginning of this chapter.

1. Remove power and check for zero voltage in the drive. Refer to *Opening the Drive Enclosure* in Chapter 3, *Access Procedures*.

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify zero bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three bus fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

2. Remove the L-shaped bus bar that is located over the thermal switch you need to replace. (Remove the the flex bus from the L-shaped bus bar if necessary.)
3. Remove the two bus bars that are over the Converter Diode.

Figure 5.30
Converter Diodes

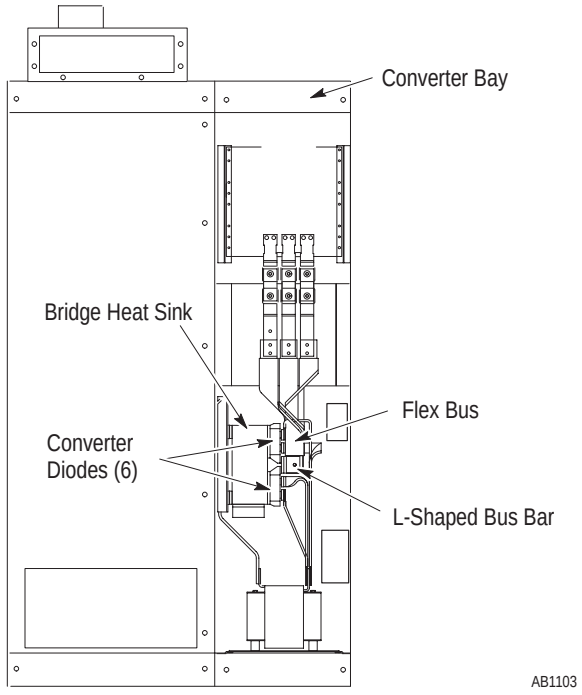
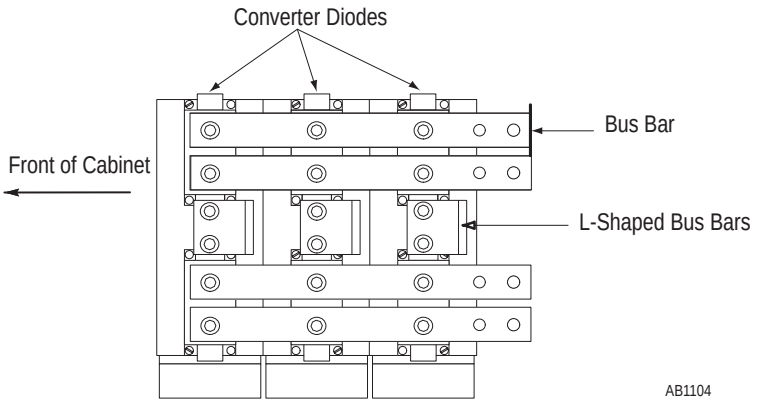


Figure 5.31
Bus Bars



4. Remove the hex head screws that are in the four corners of the Converter Diode.
5. Remove the Converter Diode.

Installation

Refer to *Fastener Torque Specifications* in Chapter 3, *Access Procedures*.

1. Apply a thin, even coat of Penatrox or equivalent (not supplied) to the base of the new diode.
2. Position the new Converter Diode. Be careful to match the holes for the screws.
3. Tighten the four screws.
4. Bolt down the L-shaped bus bar with two bolts.
5. Bolt down the two bus bars with six bolts.
6. If not connected, connect the Flex bus.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

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Replacement Parts List

Chapter Objectives

This chapter illustrates and lists replacement parts for the 1336 IMPACT Drives rated B700C – B800C and C700C – C800C and describes replacement parts ordering procedures.

Ordering Replacement Parts

For your convenience, the Allen-Bradley Drives Division and the Rockwell Automation Support Division provide efficient and convenient repair and exchange for eligible equipment.

A product service report number is required to return any equipment for repair. Your local Rockwell Automation distributor or area sales and support office can provide you with a product service report number.

You should return equipment to be repaired to the area sales and support center nearest you. Reference the product service report number on the carton and packing slip. Include:

- Your company name
- Your company address
- The repair purchase order number
- A brief description of the problem

Contact your local Rockwell Automation distributor or sales office for a complete listing of area sales and support centers near you.

For parts catalog numbers, refer to the 1336 IMPACT Spare Parts Pricing publication included with your drive documentation set.

Replacement Parts Listing

Figure 6.1
Replacement Parts

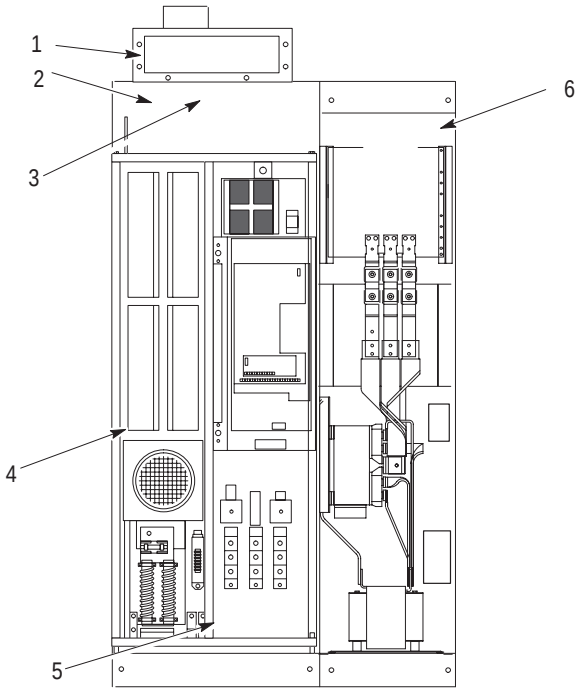


Table 6.A
Replacement Parts

Callout	Symbol on Job Related Schematics	Description	Procedures		
			Access[1]	Test	Replacement
1	Fan1[2]	Main Enclosure Fan	Does Not Apply (DNA)	DNA	DNA
2	OL12	Overload Relay	DNA	DNA	DNA
3	F20 – F22	Fuse	DNA	DNA	DNA
4	–	Inverter Assembly – Refer to Table 6.B and Table 6.C			
5	–	Capacitor Assembly – Refer to Table 6.D			
6	–	Converter Bay[2] – Refer to Table 6.E			

1. Access always requires the procedure: *Opening the Drive Enclosure*.
2. The schematics supplied for configured systems include the spare parts list for the Converter Bay and the enclosure fan.

Figure 6.2
Inverter Assembly Replacement Parts

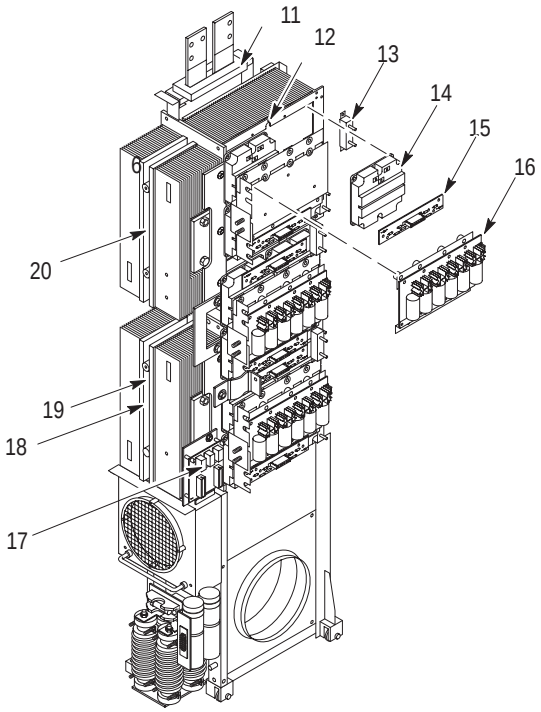


Table 6.B
Inverter Assembly Replacement Parts

Callout	Symbol on Chapter 7 Schematics	Description	Procedures		
			Access[1] (Ref: Ch. 3)	Test (Ref: Ch. 4)	Replacement (Ref: Ch. 5)
11	CT3	Current Fault Transformer	DNA	DNA	*Replacing the Current Sense Transformer*
12	NTC1	Thermistor	DNA	Test 5	*Replacing a Thermistor*
13	R20 – R25	Power Module Snubber Resistor	*Pulling the Inverter Assembly*	Test 2	*Replacing a Power Module*
14	Q11 – Q12, . . . Q61 – Q62	Power Module Transistor	*Pulling the Inverter Assembly*	Test 2	
15	A23 – A28	Power Module Gate IF Board	*Pulling the Inverter Assembly*	DNA	
16	A20 – A22	Power Module Snubber Board	*Pulling the Inverter Assembly*	Test 2	*Replacing a Power Module Snubber Board*
17	–	Input Rectifier Snubber Board	DNA	DNA	*Replacing an Input Rectifier Board*
18	SCR1	SCR	DNA	Test 4	*Replacing a Diode, SCR, or Thermostat*
19	THS1	Thermostat	DNA	Test 5	
20	D4	Diode	DNA	Test 4	

1. Access always requires the procedure: *Opening the Drive Enclosure*.

Figure 6.3
Fan Assembly Replacement Parts

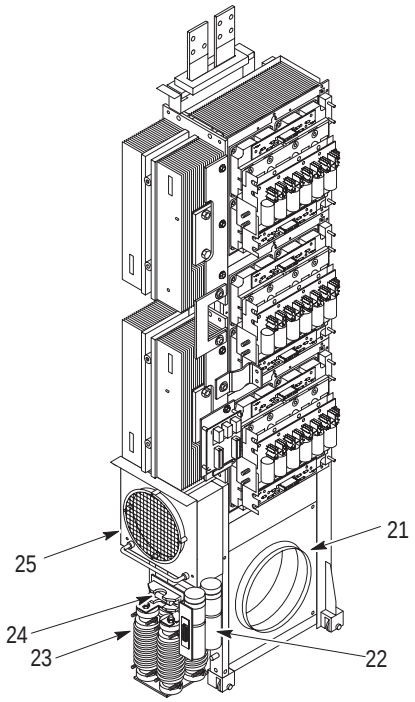


Table 6.C
Fan Assembly Replacement Parts

Callout	Symbol on Chapter 7 Schematics	Description	Procedures		
			Access[1] (Ref: Ch. 3)	Test (Ref: Ch. 4)	Replacement (Ref: Ch. 5)
21	FAN1	Fan	DNA	DNA	*Replacing Inverter Bay Fan Assemblies*
22	C38 – C39	Capacitor	DNA	DNA	DNA
23	R10 – R13	Resistor	DNA	DNA	DNA
24	F4	Fuse	DNA	DNA	DNA
25	FAN2	Fan	DNA	DNA	*Replacing Inverter Bay Fan Assemblies*

1. Access always requires the procedure: *Opening the Drive Enclosure*.

Figure 6.4
Capacitor Assembly Replacement Parts

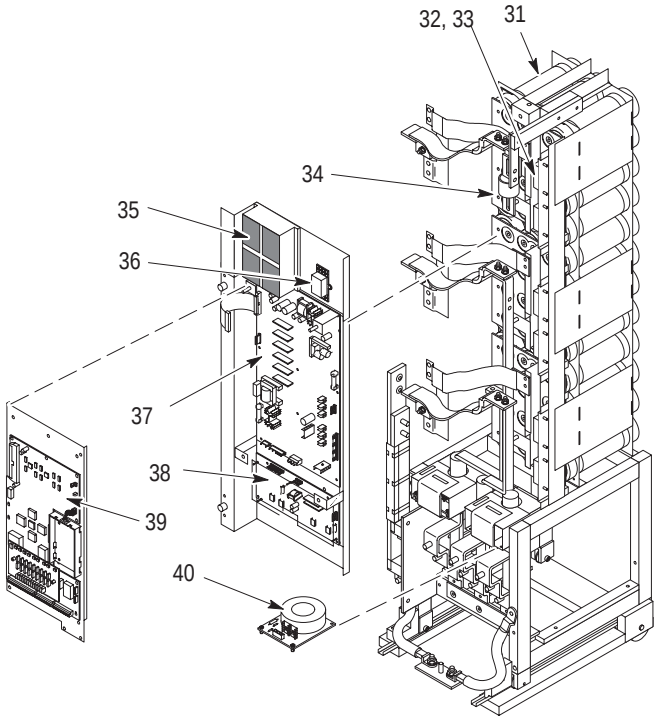
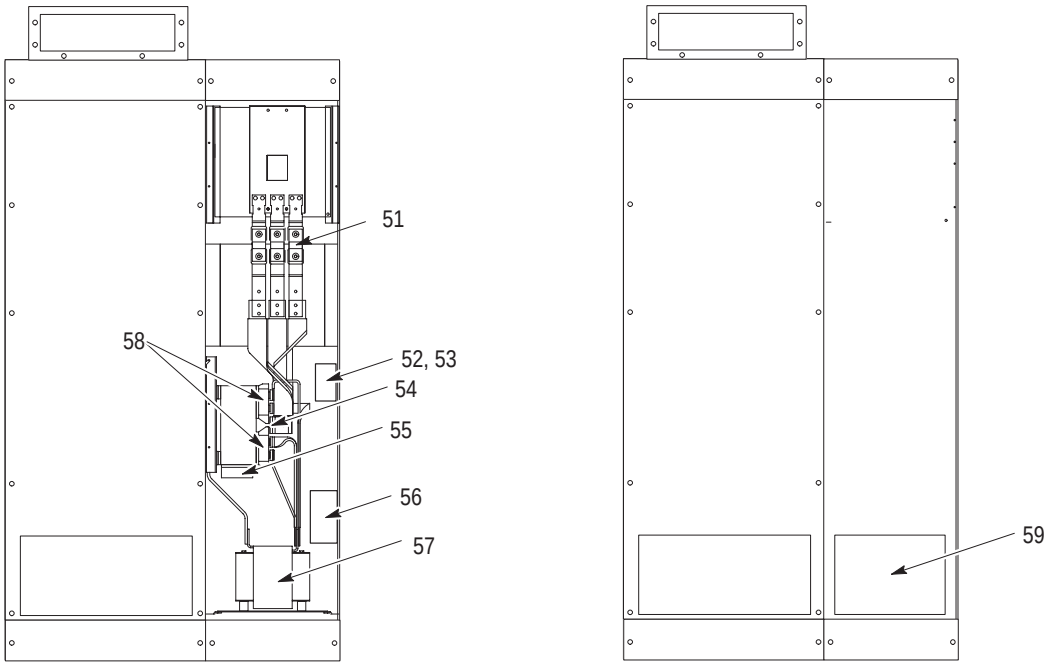


Table 6.D
Capacitor Bank Assembly Replacement Parts

Callout	Symbol on Chapter 7 Schematics	Description	Procedures		
			Access[1] (Ref: Ch. 3)	Test (Ref: Ch. 4)	Replacement (Ref: Ch. 5)
31	C1 – C36	Bus Capacitors	*Removing the Motor Bus* *Pulling the Capacitor Bank Assembly*[2]	DNA	*Replacing Bus Capacitors*
32	R1 – R9	Volt-Sharing Resistor	DNA[2]	Test 3	*Replacing Volt-Sharing Resistors and Dual Diodes*
33	D1 – D2	Dual Diode	DNA[2]	DNA	
34	F1 – F3	Bus Fuse, 350 amp	DNA	DNA	*Replacing Bus Fuses*
35	–	Power Supply	DNA	DNA	*Replacing the Power Supply*
36	R1	Relay	DNA	DNA	DNA
37	A1	Gate Driver Board	*Removing the Control Board Mounting Plate*	Test 1	*Replacing the Gate Driver Board*
38	A10	Common Bus Precharge Board		DNA	*Replacing the Precharger Board*
39	MAIN CTL	Control Board	DNA	DNA	*Replacing the Control Board*
40	CT1, CT2	Current Transducer	*Removing the Motor Bus*	DNA	*Replacing Current Transducers*

1. Access always requires the procedure: *Opening the Drive Enclosure*.
2. Access also requires the procedures: *Removing the Control Board Mounting Plate* and *Removing the Precharge Board Mounting Frame*.

Figure 6.5
Typical Converter Bay Replacement Parts



Important: This listing is typical. See the schematics supplied for configured systems for the spare parts list for the Converter Bay and the enclosure fan.

Table 6.E
Typical Converter Bay Replacement Parts

Callout	Symbol on Job Related Schematics	Description	Procedures		
			Access[1] (Ref: Ch. 3)	Test (Ref: Ch. 4)	Replacement (Ref: Ch. 5)
51	F1 – F3, F1A – F3A	Fuse	DNA	DNA	DNA
52	EA11	Line Loss Relay	DNA	DNA	DNA
53	MOV	MOV	DNA	DNA	DNA
54	EA10	Thermal Switches	DNA	DNA	*Replacing Converter Thermal Switches*
55	–	Converter Fans	DNA	DNA	*Replacing Converter Fans*
56	EA12	DC Snubber Board	DNA	DNA	DNA
57	CH10	DC Bus Inductor	DNA	DNA	DNA
58	–	Converter Bridge Diodes	DNA	DNA	*Replacing Converter Diodes*
59	–	Door Fan	DNA	DNA	*Replacing Converter Bay Door Fan*

1. Access always requires the procedure: *Opening the Drive Enclosure.*

Schematics

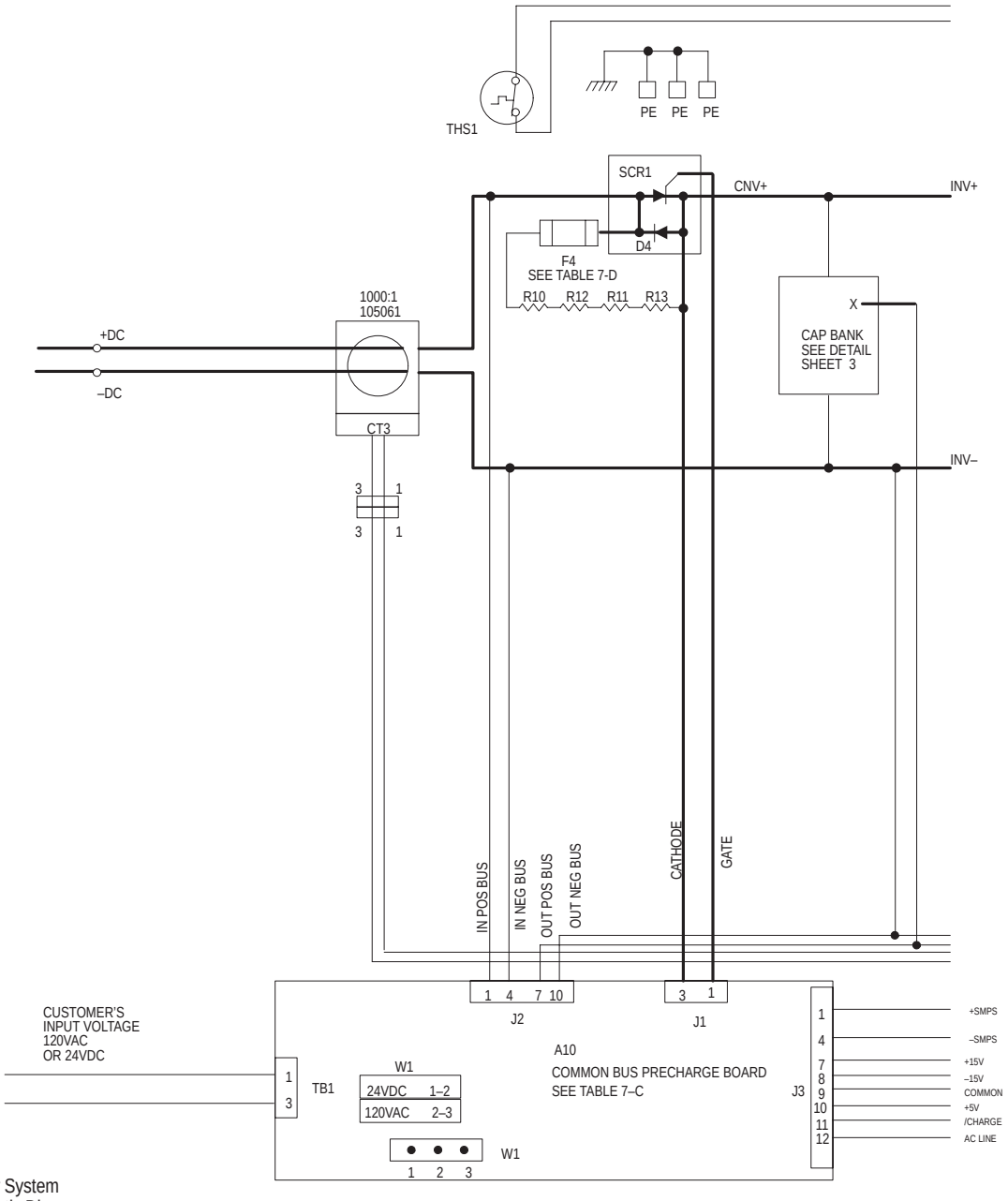
Chapter Objectives

This chapter provides:

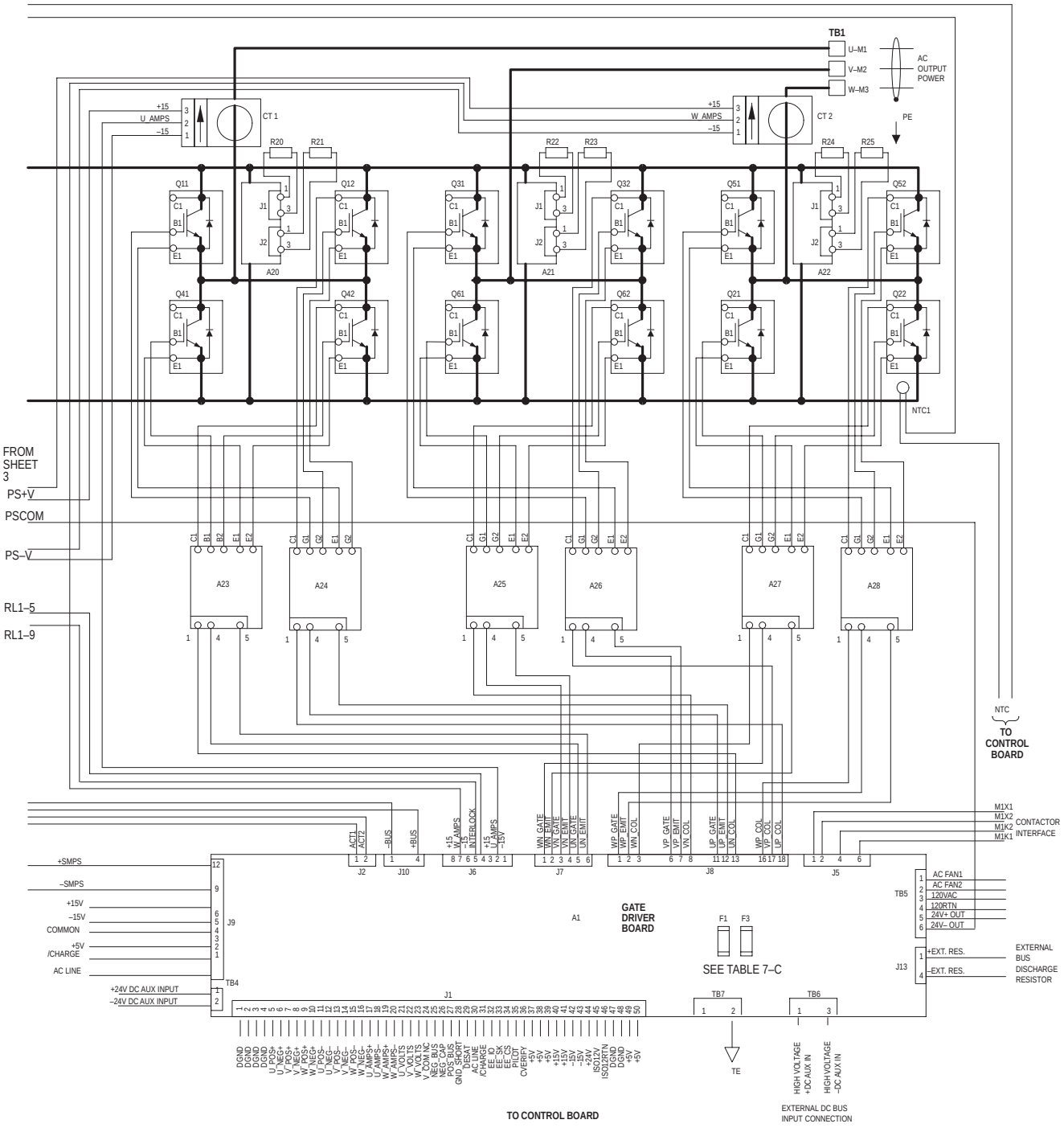
- The Inverter Bay schematic for a typical drive.
- The Control Board layout.
- Typical Converter Bay and system schematics. Since each drive is configured, the Converter Bay and full schematics for the drive, as configured, are shipped inside the cabinet.
- Fuse Listings

Inverter Bay Schematic

Schematic diagram for the 800 horsepower drive.

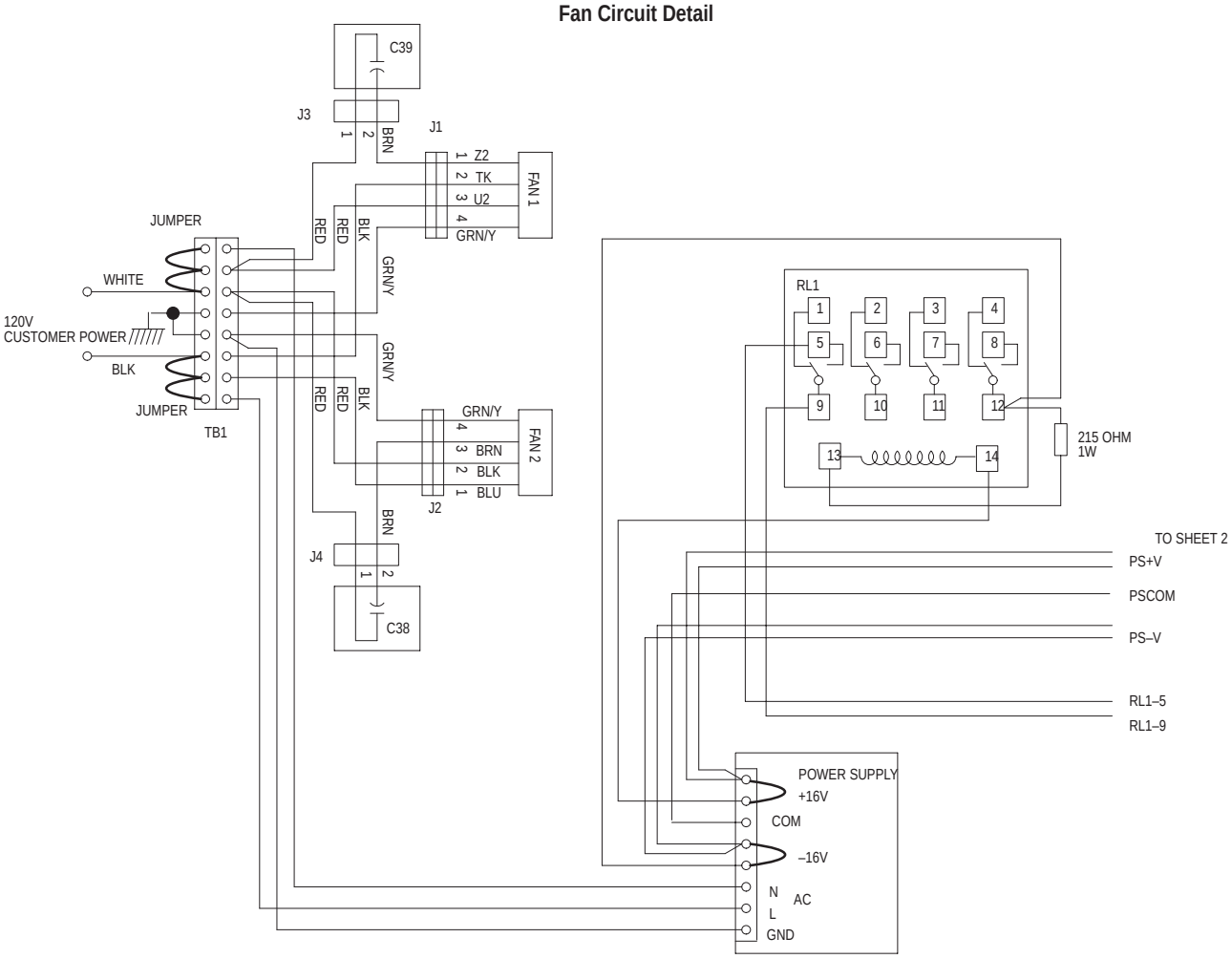


Inverter System
Schematic Diagam
Common Bus Unit
800 HP
Sheet 1 of 3

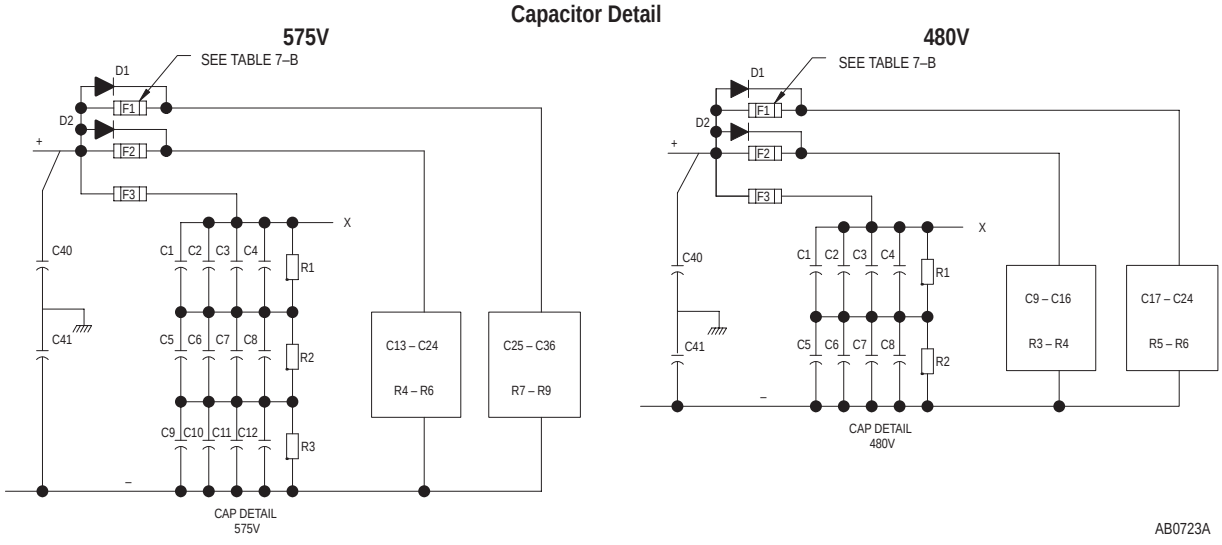

TB1
U–M1
V–M2
W–M3
AC OUTPUT POWER
PE
CT 1
CT 2
+15
U_AMPS
–15
W_AMPS
R20
R21
R22
R23
R24
R25
Q11
Q12
Q31
Q32
Q51
Q52
Q41
Q42
Q61
Q62
Q21
Q22
A20
A21
A22
NTC1
FROM SHEET 3
PS+V
PSCOM
PS–V
RL1–5
RL1–9
A23
A24
A25
A26
A27
A28
NTC
TO CONTROL BOARD
M1X1
M1X2
M1K2
M1K1
CONTACTOR INTERFACE
+SMPS
–SMPS
+15V
–15V
COMMON
+5V /CHARGE
AC LINE
+24V DC AUX INPUT
–24V DC AUX INPUT
J9
TB4
J2
J10
J6
J7
J8
J5
A1
GATE DRIVER BOARD
F1
F3
SEE TABLE 7–C
TB5
AC FAN1
AC FAN2
120VAC
120RTN
24V+ OUT
24V– OUT
J13
+EXT. RES.
–EXT. RES.
EXTERNAL BUS DISCHARGE RESISTOR
J1
TB7
TB6
TE
HIGH VOLTAGE +DC AUX IN
HIGH VOLTAGE –DC AUX IN
TO CONTROL BOARD
EXTERNAL DC BUS INPUT CONNECTION

Sheet 2 of 3

Fan Circuit Detail

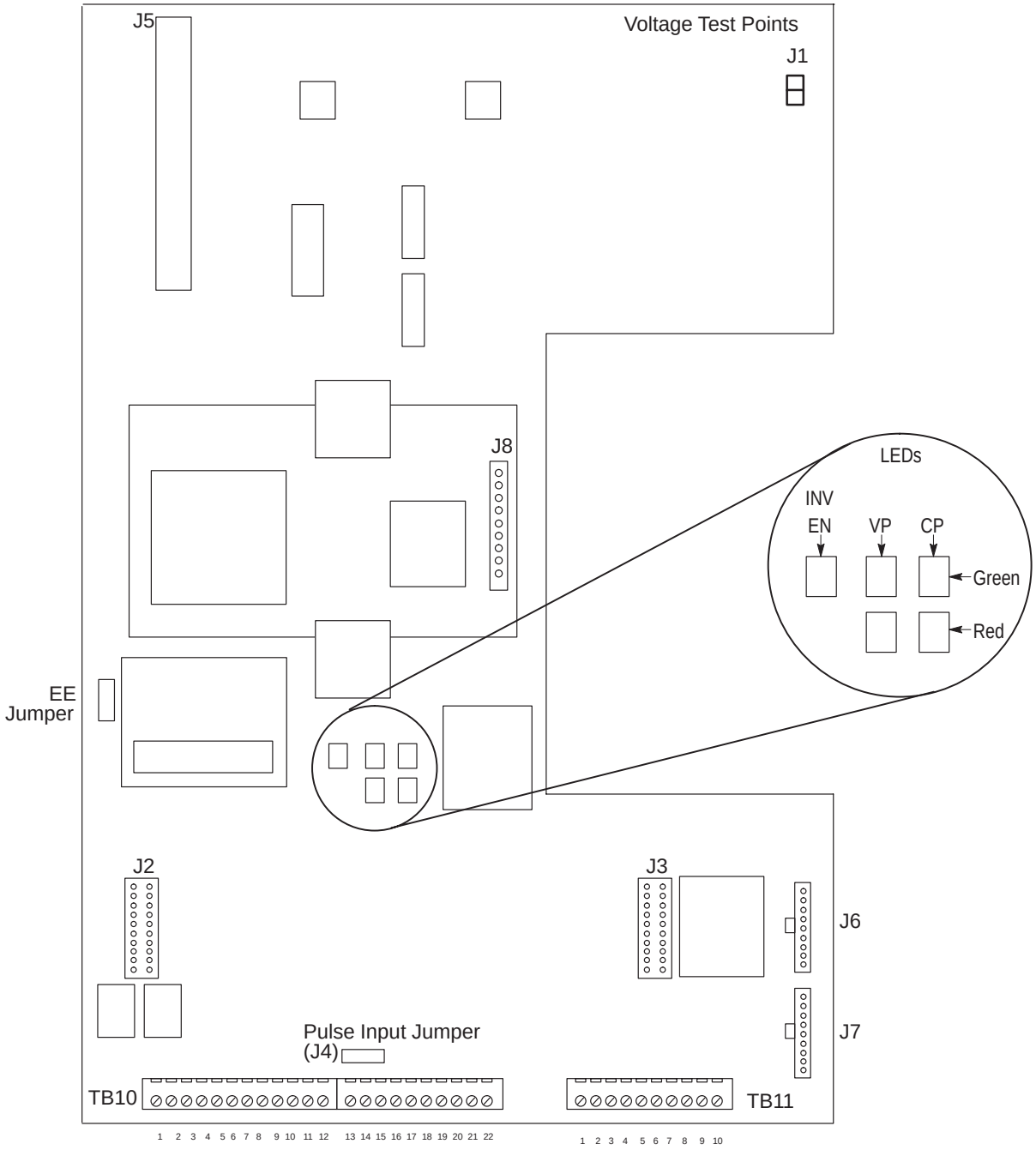


Capacitor Detail

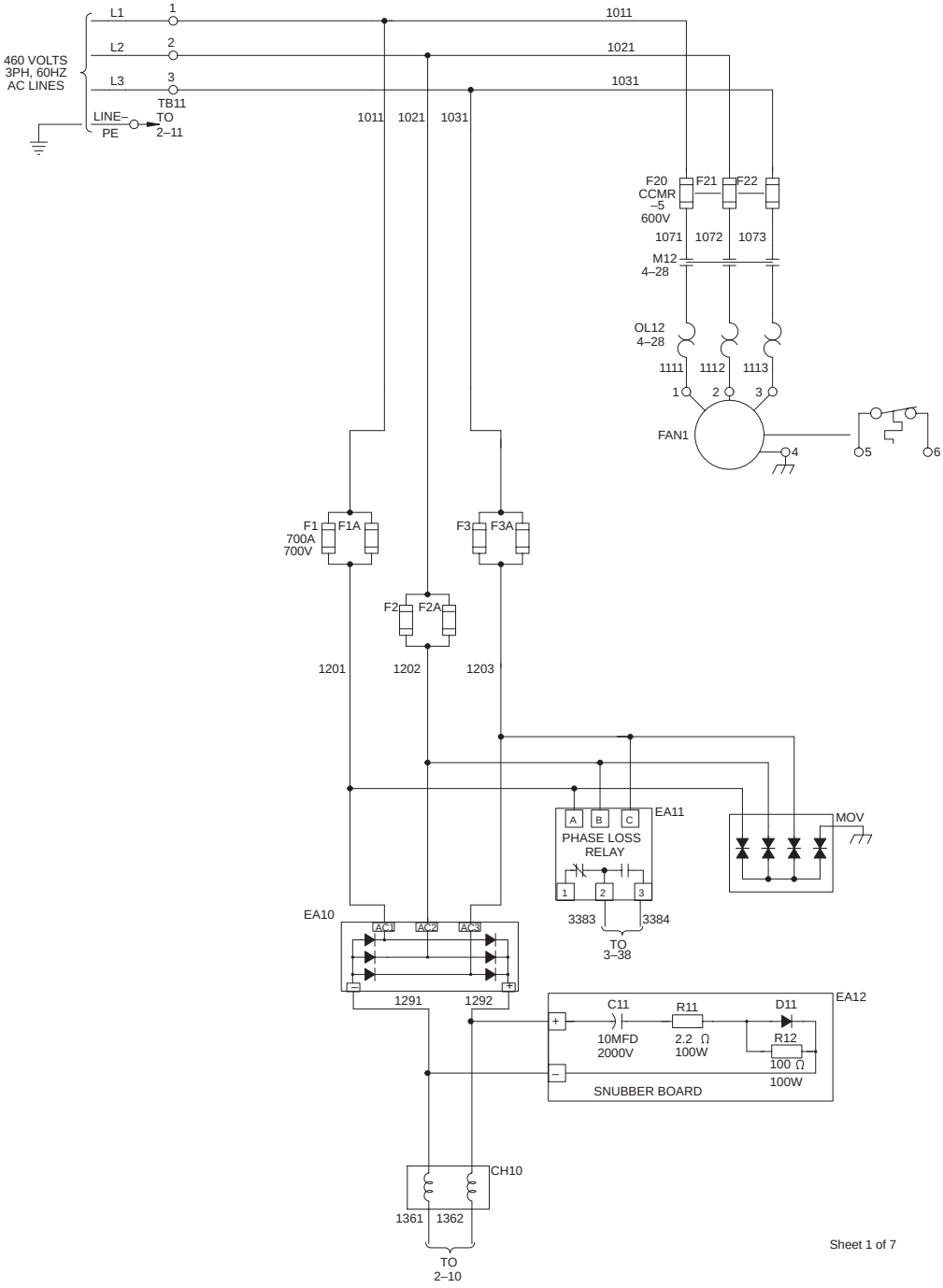


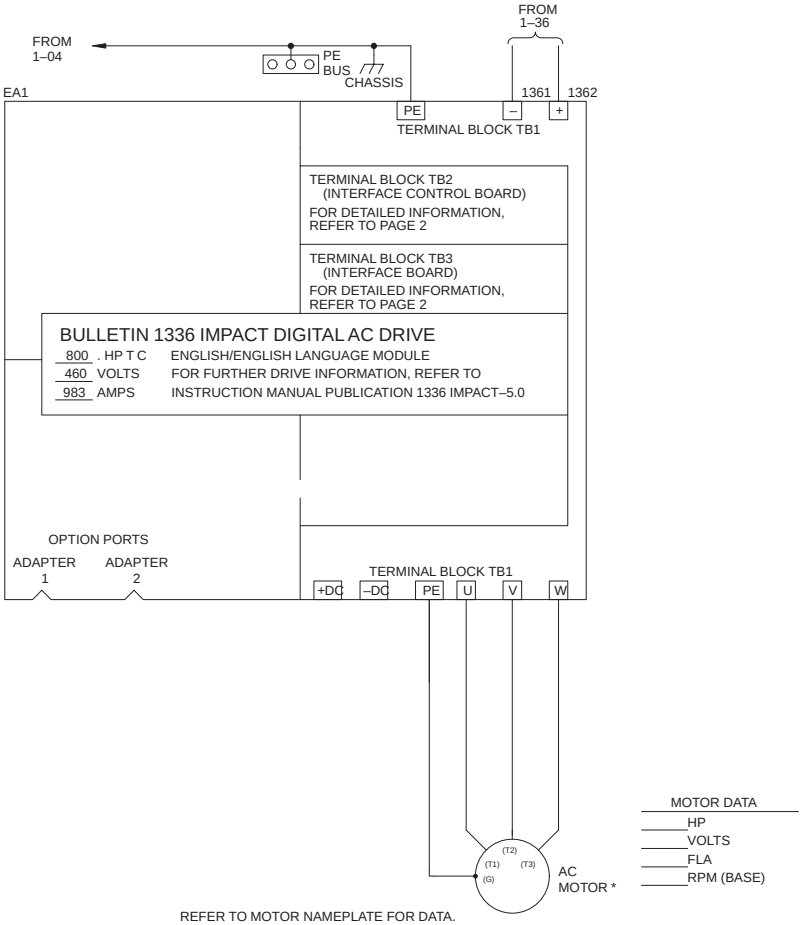
Sheet 3 of 3

Control Board Layout



Typical Converter Bay Schematic

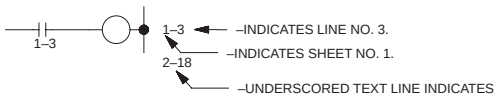




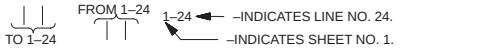
REFER TO MOTOR NAMEPLATE FOR DATA.
MOTOR FLA MUST NOT EXCEED DRIVE AMP RATING.

GENERAL NOTES:

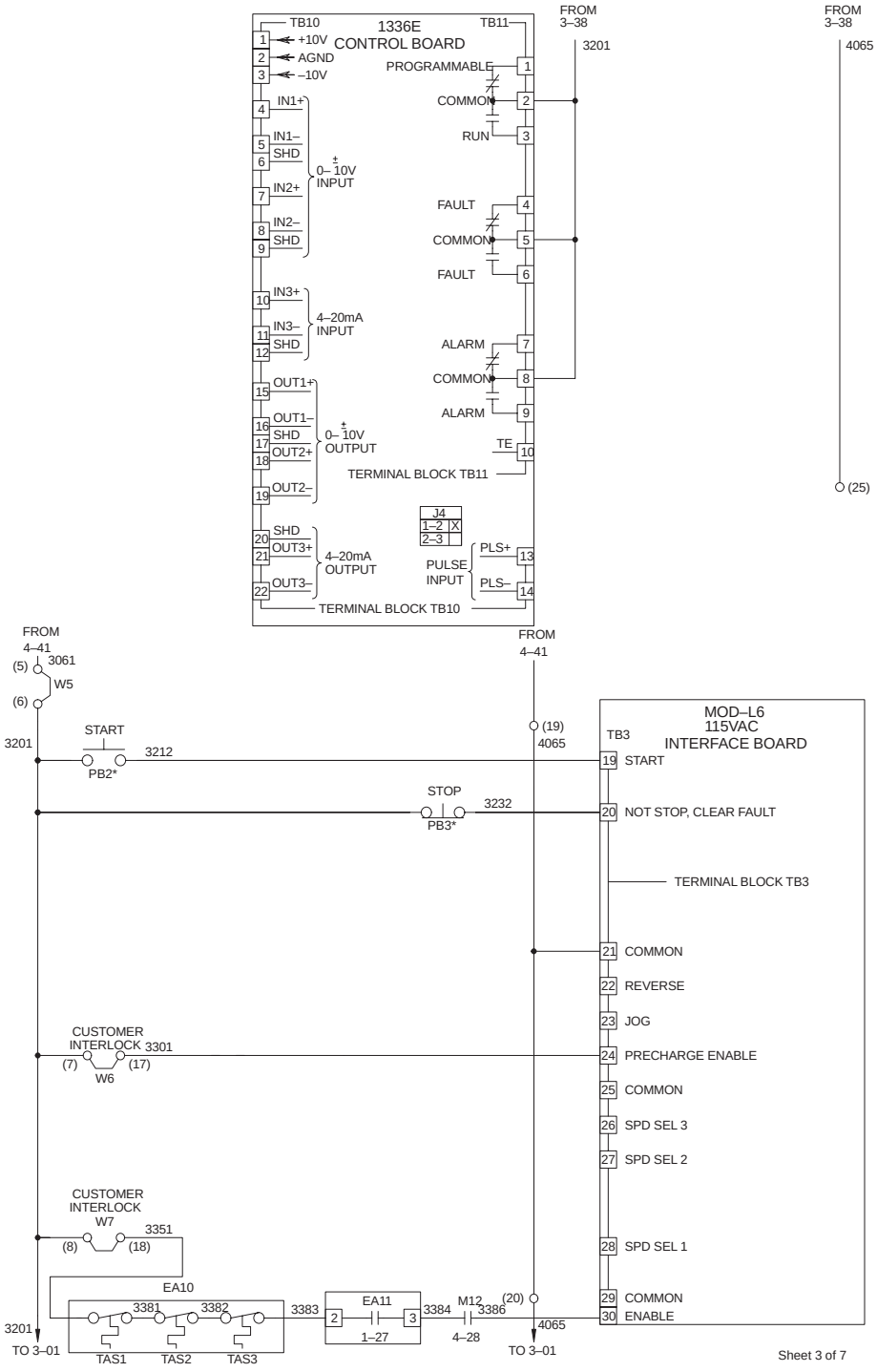
1. – BUILDING GROUND TO BE GROUNDED BY CUSTOMER.
   – SIGNAL COMMON
   – POWER EQUIPMENT GROUND
   – CHASSIS CONNECTION.
2. * –INDICATES COMPONENTS SUPPLIED BY OTHERS.
3. –INDICATES TB4 TERMINAL BLOCK.
   4 –INDICATES TERMINAL ON INDIVIDUAL COMPONENTS.
4. COIL AND CONTACT CROSS REFERENCING – NUMBERS ADJACENT TO COIL AND UNDER CONTACT INDICATE SHEET AND LINE NUMBERS.

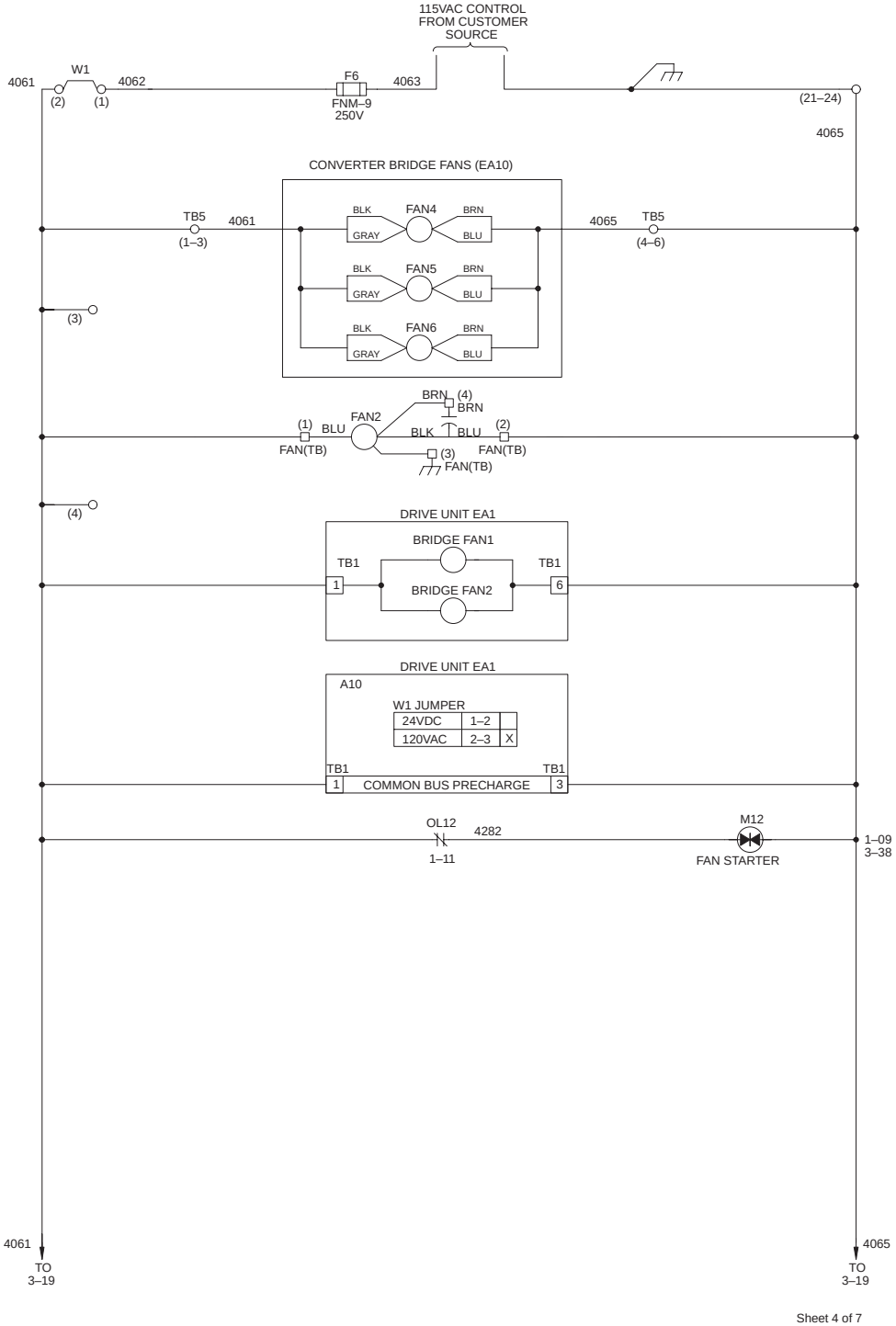


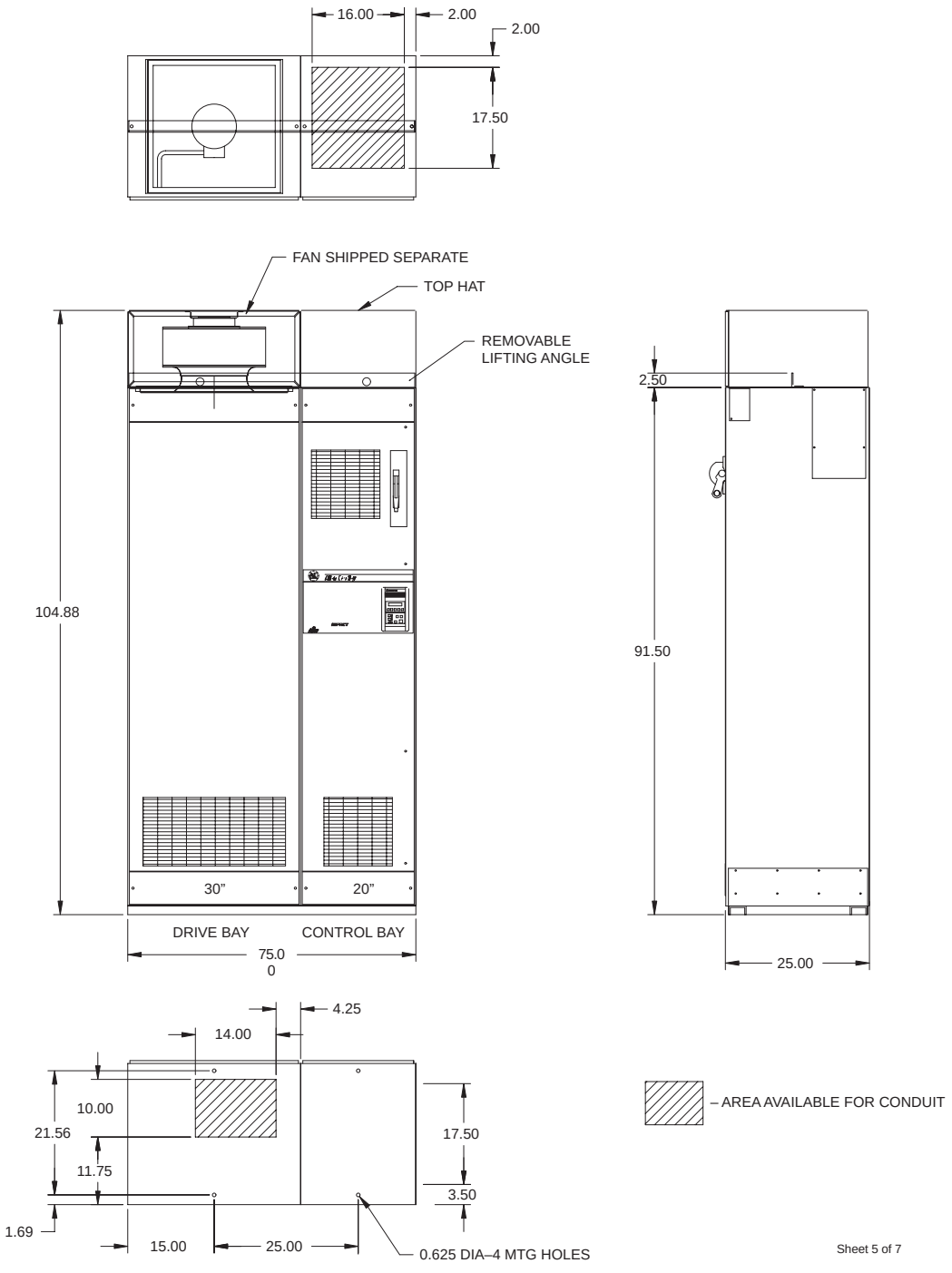
OFF–PAGE CROSS REFERENCING – NUMBERS ADJACENT TO SOURCE AND DESTINATION SYMBOLS INDICATE SHEET AND LINE NUMBERS.



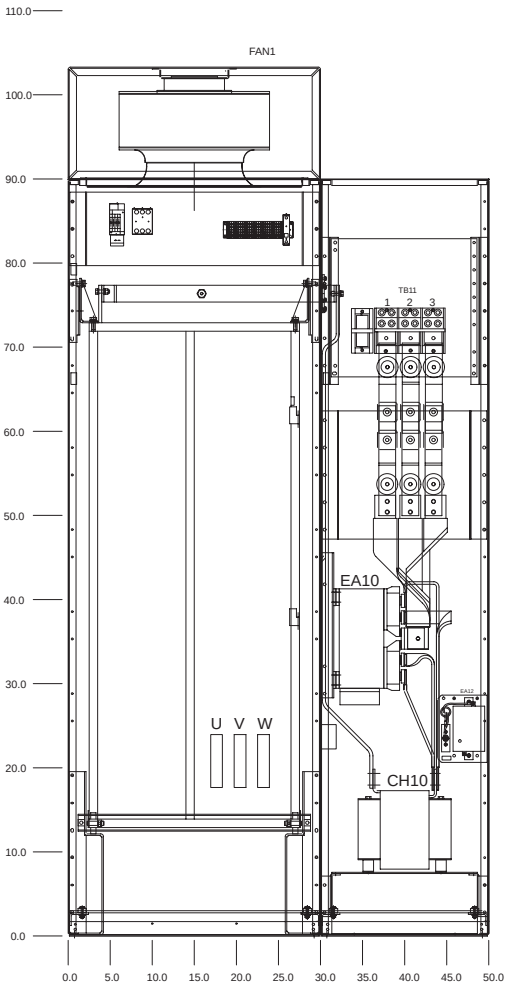
Sheet 2 of 7

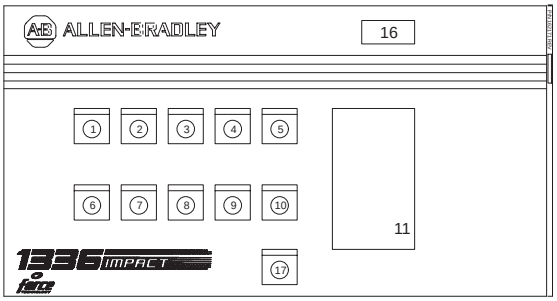

1336E
CONTROL BOARD
TB10
TB11
+10V
AGND
–10V
IN1+
IN1–
SHD
IN2+
IN2–
SHD
0– ±10V INPUT
IN3+
IN3–
SHD
4–20mA INPUT
OUT1+
OUT1–
SHD
OUT2+
OUT2–
0– ±10V OUTPUT
SHD
OUT3+
OUT3–
4–20mA OUTPUT
PROGRAMMABLE
COMMON
RUN
FAULT
COMMON
FAULT
ALARM
COMMON
ALARM
TE
TERMINAL BLOCK TB11
J4
1–2 X
2–3
PULSE INPUT
PLS+
PLS–
TERMINAL BLOCK TB10
FROM 3–38
3201
FROM 3–38
4065
(25)
FROM 4–41
(5) 3061
W5
(6)
3201
START
PB2*
3212
FROM 4–41
(19)
4065
STOP
PB3*
3232
MOD–L6
115VAC
INTERFACE BOARD
TB3
19 START
20 NOT STOP, CLEAR FAULT
TERMINAL BLOCK TB3
21 COMMON
22 REVERSE
23 JOG
24 PRECHARGE ENABLE
25 COMMON
26 SPD SEL 3
27 SPD SEL 2
28 SPD SEL 1
29 COMMON
30 ENABLE
CUSTOMER INTERLOCK 3301
(7) (17)
W6
CUSTOMER INTERLOCK
W7
3351
(8) (18)
EA10
3381
3382
3383
EA11
2 3
1–27
3384
M12
3386
(20)
4–28
4065
3201
TO 3–01
TAS1
TAS2
TAS3
TO 3–01
Sheet 3 of 7


115VAC CONTROL
FROM CUSTOMER
SOURCE
4061
W1
(2)
(1)
4062
F6
FNM–9
250V
4063
(21–24)
4065
CONVERTER BRIDGE FANS (EA10)
TB5
(1–3)
4061
BLK
GRAY
FAN4
BRN
BLU
4065
TB5
(4–6)
BLK
GRAY
FAN5
BRN
BLU
BLK
GRAY
FAN6
BRN
BLU
(3)
BRN
(4)
BRN
(1)
BLU
FAN2
BLK
BLU
(2)
FAN(TB)
FAN(TB)
(3)
FAN(TB)
(4)
DRIVE UNIT EA1
BRIDGE FAN1
TB1
1
BRIDGE FAN2
TB1
6
DRIVE UNIT EA1
A10
W1 JUMPER
24VDC
1–2
120VAC
2–3
X
TB1
1
COMMON BUS PRECHARGE
TB1
3
OL12
1–11
4282
M12
FAN STARTER
1–09
3–38
4061
TO
3–19
4065
TO
3–19
Sheet 4 of 7


16.00
2.00
2.00
17.50
FAN SHIPPED SEPARATE
TOP HAT
REMOVABLE
LIFTING ANGLE
104.88
30”
20”
DRIVE BAY
CONTROL BAY
75.0
0
2.50
91.50
25.00
4.25
14.00
10.00
21.56
11.75
17.50
3.50
1.69
15.00
25.00
0.625 DIA–4 MTG HOLES
– AREA AVAILABLE FOR CONDUIT

Sheet 5 of 7





DEVICE	DESCRIPTION	DEVICE	DESCRIPTION
1	NOT USED	9	NOT USED
2	NOT USED	10	NOT USED
3	NOT USED	11	NOT USED
4	NOT USED	12	NOT USED
5	NOT USED	13	NOT USED
6	NOT USED	14	NOT USED
7	NOT USED	15	NOT USED
8	NOT USED	16	NOT USED
		17	NOT USED

DIMENSIONS ARE IN MILLIMETERS (INCHES).
3000 lbs;1360 kg; APROXIMATE SHIPPING WEIGHT.

162560

DATA NAMEPLATE

CAT. NO. 1336 E–B800C–AA

SERIES A

ORDER NO. SAMPLE–DWG

SERIAL NO. SAMPLE–DWG

WIRING DIA. SAMPLE–DWG–2

H.P. 800 AMPS 983

ENCLOSURE TYPE: TYPE 1

CONSTANT TORQUE: X

VARIABLE TORQUE:

FACILITY: 1C

POWER RATINGS
3–PHASE AC INPUT
KVA 769 VOLTS 460 HZ 50/60 AMPS 965
3–PHASE AC OUTPUT
KVA 783 VOLTS 460 HZ 0–400 AMPS 983
MAXIMUM RMS SHORT CIRCUIT CURRENT AMPS 65000

Allen-Bradley
MADE IN U.S.A.

Sheet 6 of 7

MATERIAL LIST – COMPONENTS

SYM.	DESCRIPTION	A–B PART NO.	MANUFACTURER/PART NO.
EA1	DRIVE UNIT	N/A	1336E–R800–AN–EN–L6
EA10	BRIDGE	177187	EUPEC/2B6U 575/775–800F/ 3KM17L 6DD600N–T
EA11	RELAY	128229	TIMEMARK/C263
EA12	SUPPRESSOR	170684	A–B/MEQUON
F1–3A	FUSES	504923	BUSSMANN/SPP–700
F6	FUSE	159010	BUSSMANN/FNM–9
F20–22	FUSES	146927	BUSSMANN/CCMR–5
EA1	15VAC CNTRL	161428	AB/1336–L6
M12	CONTACTOR	300642	AB/100–C09D10
OL12	OVERLOAD	300658	AB/193–EA4DB
CH10	CHOKE	177300	GRAND/C042
FAN1	FAN MOTOR	310238	EBM/RH45M–4/125497
FAN2	FAN MOTOR	186190	EBM/W2E250–CB13–51
MOV	SURGE SUPPRES	166095	COLLMER/CS9107A4

CONTROL

SEE INSTRUCTION MANUAL FOR CABLE CLASSES
CLASSES 5 AND 6 ARE CONTROL WIRES, 15 AMPS OR LESS

INTERCONNECTION INFORMATION

WIRE NO.	SOURCE	EXPLANATION	TERMINAL	CABLE RANGE	TYPE
4063	F6–1	115VAC	22–14 Ga	PER	
4065	FROM CUSTOMER	NEC			
	3201	TB4–6	STOP PB	#22–14 Ga.	PER
	3232	TB3–20	CODE		
	3201	TB4–6	START PB	#22–14 Ga.	PER
	3212	TB3–19	CODE		

GENERAL WIRING NOTES

1. CUSTOMER TERMINALS ARE SIZED FOR 755C WIRE PER NEC TABLE 310–16 (755C)
2. STEEL CONDUIT IS RECOMMENDED FOR ALL WIRING CLASSES, BUT IS REQUIRED FOR SIGNAL CATEGORY CLASSES. ALUMINUM CONDUIT REQUIRES THE SAME MINIMUM SPACING AS SHOWN FOR CABLE TRAYS.
3. SPACES BETWEEN CLASSES SHOWN IN THE INSTRUCTION MANUAL IS THE MINIMUM REQUIRED FOR PARALLEL RUNS EQUAL TO OR LESS THAN 400 FEET. GREATER SPACING SHOULD BE USED WHERE POSSIBLE.
4. No. 16 Ga. WIRE IS THE MINIMUM RECOMMENDED SIZE FOR CONTROL WIRE. POWER WIRE IS SELECTED BY CONTINUOUS MAXIMUM LOAD (FLA).
5. SHIELDS FOR SHIELDED SIGNAL CABLE MUST BE CONNECTED AT ONE END ONLY. THE OTHER END SHOULD BE CUT BACK AND INSULATED. IT IS RECOMMENDED THAT SHIELDS FOR SHIELDED CABLE FROM A CABINET TO AN EXTERNAL DEVICE BE CONNECTED AT THE CABINET END OF THE CABLES. SHIELDS FOR SHIELDED POWER CABLE (MOTOR LEADS) MUST BE CONNECTED AT BOTH ENDS. THE SPLICING OF SHIELDED CABLES, IF NECESSARY, SHOULD BE DONE SUCH THAT THE SHIELD(S) REMAIN CONTINUOUS AND INSULATED FROM GROUND.

EXTERNAL INTERCONNECT WIRING REQUIREMENTS

POWER

SEE INSTRUCTION MANUAL FOR CABLE CLASSES

INTERCONNECTION INFORMATION

CURR. NO.	WIRE SOURCE	EXPLANATION	TERMINAL	WIRE RANGE
965	L1	TB11–1	INCOMING	500LB–IN (4)2Ga–600M
	L2	TB11–2	460 V	LINES
	L3	TB11–3		
	2	GRND	LINE–PE	GROUND EQMT
		CONDUCTOR		
	FRAME	MTR–PE		
	SEE 2	N/A	1T1	EA1–TB1(U) AC MOTOR (3)#14–600M
	MTR	1T2	EA1–TB1(V)	
	N/P	1T3	EA1–TB1(W)	
	FRAME	MTR–PE		
	SEE 1111	OL1(T1)	FAN1	#14Ga
	MTR 1112	OL1(T2)		
	N/P 1113	OL1(T3)		
	GND	CHASSIS	GND	

SIGNAL

SEE INSTRUCTION MANUAL FOR CABLE CLASSES
CLASSES 7 THROUGH 12 ARE SIGNAL WIRES, 5 AMPS OR LESS

INTERCONNECTION INFORMATION

CLASS NO.	WIRE NO.	SOURCE	EXPLANATION	TERMINAL	CABLE RANGE	TYPE

Sheet 7 of 7

Fuse Tables

Based on the maximum drive rating the following fuses, or approved equivalents, must be used for the AC input power.

Table 7.A
AC Input Power, Converter Bay Fuses (F1 – F3 and F1A – F3A)

Horsepower	AC Input Voltage	Fuse Type
700 and 800	480 and 575	SPP-6K700 Bussman

Based on the drive horsepower, the following fuses, or approved equivalents, must be used for the Inverter DC+ Bus.

Table 7.B
Inverter DC+ Bus Fuses (F1 – F3)

Horsepower/ Input Voltage	Fuse Information		
	Rating	Type	P/N
ALL SIZES	300A	A7OQ	25178-310-14

Table 7.C lists fuse data for all printed circuit assemblies.

Table 7.C
Printed Circuit Fuses

Item	B/M	Schematic Diagram	Fuse Information			
			Designator	Rating	Type	P/N
A1 Gate Driver Board	74101-163-XX	74101-167	F1	1.0 A/600 V	KTK-R	25172-260-08
			F3	1.5 A/600 V	KTK-R	25172-260-09

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A

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Auxiliary Interlock, Definition, P–8

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